Minerals yearbook: Area reports: international 1980. Year 1980, Volume 3 1980

Bureau of Mines
Washington, D. C.: Bureau of Mines : United States Government Printing Office, 1980

Minerals Yearbook

1980

Volume III

AREA REPORTS: INTERNATIONAL

Prepared by staff of the

BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR • James G. Watt, Secretary

BUREAU OF MINES • Robert C. Horton, Director

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, and park and recreation areas, and for the wise use of all those resources. The Department also has a major responsibility for American Indian reservation communities and for the people who live in Island Territories under U.S. administration.

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON : 1982

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Foreword

Through the Minerals Yearbook and its predecessor volumes, the Federal Government has reported annually on mineral industry activities since 1882. This edition discusses the performance of the worldwide mineral industry during 1980 and provides background information to assist in interpreting developments during the year being reviewed. Content of the individual volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and nonmetallic mineral commodities important to the U.S. economy. In addition, it includes a chapter on mining and quarrying trends.

Volume II, Area Reports: Domestic, contains chapters on the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, and the Commonwealth of Puerto Rico. This volume also has a statistical summary.

Volume III, Area Reports: International, contains the latest available mineral data on more than 130 foreign countries and discusses the importance of minerals to the economies of these nations. A separate chapter reviews the international minerals industry in general and its relationship to the world economy.

The Bureau of Mines continually strives to improve the value of its publications to its users. Therefore, the constructive comments and suggestions of readers of the Yearbook will be welcomed.

Robert C. Horton, *Director*

Acknowledgments

In preparing this volume, the Bureau of Mines utilized extensively statistical and other data on mineral production, consumption, and trade provided by various foreign government mineral and statistical agencies through a variety of official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material was also obtained from airgrams of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular assistance were the routine and special reports submitted by the minerals, petroleum, economic, and commercial officers and other members of the Department of State. Their contributions are sincerely appreciated.

The text and tables of this volume were prepared by the staff of the Branch of Foreign Data, Division of Production/Consumption Data Collection and Interpretation. Final correlation and checking of this volume was performed by the Division of Publication.

The regimes of some countries reviewed in this volume are not recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not construed as conflicting with or being contradictory of U.S. policies toward these countries.

Albert E. Schreck, *Chief, Division of Publication*

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Minerals in the World Economy

By Charles L. Kimbell[1] and John Panulas[2]

The year 1980 on the whole was not a good year for the world's mineral industry. The general upturn of activities in 1979 after a rather poor 1978 showing was not maintained with a number of key measurement standards showing downturns. Most notably, the world's steel and petroleum industries recorded significant reductions in output, the former in response to markedly lower demand levels and the latter partly in response to lower industrial consumption owing to general economic conditions and partly owing to successes in campaigns for the reduction of energy use in general and petroleum product use in particular among major importing nations that were feeling the trade balance pinch of ever-higher oil prices.

During 1980, a number of political events—some international in scope, some confined to single nations—had significant influence upon world mineral industry activities and mineral commodity supplies, and other political happenings had the potential to significantly affect the industry in future times.

Unquestionably the most notable events were those occurring in Iran and Iraq. At the start of the year, the spotlight was on Iran alone, where, with the tacit approval of the Khomeini regime, highly militant so-called students continued to hold U.S. Embassy personnel as prisoners, with no regard for accepted international diplomatic practice. As the year progressed, with U.S. embargoes on shipments of industrial materials (including much-needed oil and gas industry equipment) and with the freeze on Iranian assets in the United States, the civil turmoil in Iran seemed outwardly to calm somewhat, and mineral industry activity, particularly that of the oil industry, began to pick up from the drastically curtailed levels of late 1979 and early 1980. In September, however, following several major border clashes between Iran and Iraq, open warfare broke out between these countries, with each side attacking not only military targets, but industrial installations, including oilfields, refineries, pipelines, and oil loading facilities. Iraq seized substantial areas of Iran's Khúzestán Province. This warfare, which drew a number of soldiers on each side from civilian positions including some in the mineral industry and which seriously damaged mineral industry facilities in both countries, sharply reduced oil output in both nations and presumably had an adverse effect on all other economic activity through yearend.

Elsewhere in the Near East, continued border clashes, guerrilla warfare, and retaliatory airstrikes hampered industrial activity, including the minerals sector, in Israel, Syria, Lebanon, and Jordan.

In Western Europe, internal economic problems, including inflation, growing unemployment, spiraling energy costs, and attendant reduced consumer demand for finished goods served almost as effectively as did the Near East's warfare as a deterrent to increased mineral industry activity.

Japanese mineral industry activity was somewhat curtailed as a result of increasing energy costs that contributed to an increasingly unsatisfactory trade balance and by reduced demand for at least some mineral-based export products. It was questionable if recessionary trends that were evident could be curbed by the traditional method of increasing exports.

In Eastern Europe, Poland's simmering labor dissatisfaction with general economic and sociopolitical conditions burst into the

open with major strikes beginning about midyear that had significant impact on the production of several mineral commodities. Moreover, the successes of the early strikes, which led to major governmental shakeups and policy changes, enhanced the worker's feelings of the ability to accomplish changes in this manner. Thus, through yearend, the threat of additional strikes loomed on the horizon, despite threats of intervention in Polish internal affairs from the U.S.S.R.

On the African Continent, problems of civil strife and externally backed guerrilla activities that were adverse to mineral industry operations were again noted in the Angola-Namibia area and in the Ethiopia-Sudan area, but in the latter case at least, some degree of improvement in the Ethiopian-Eritrean internal strife seemed likely as a result of successful meetings between Ethiopian and Sudanese officials. These meetings resulted in Sudan cutting off supplies to some of the rebellious Eritreans and in a corresponding reduction in Ethiopian-Sudanese international tensions. In Zaire, there was none of the open warfare of the late seventies, and guerrilla activities apparently were minimal, with a resulting improvement in continuity of mineral industry operations.

In Latin America, the continued instability of the Near East stimulated oil industry activities, most notably in Mexico but to a measurable extent elsewhere. The Central American republics continued to experience largely internal political problems; while Nicaragua seemed to edge toward some degree of stability under its new regime, Costa Rica, El Salvador, and Guatemala suffered from intensified civil unrest, all of which had an unavoidable effect on mineral industry activity there.

In China, despite some apprehensions over possible changes in United States-Chinese relations when the Reagan administration came into office, relations with the West continued to improve, with increases in trade, including mineral commodities, being quite evident. Mineral industry operations in the industrial north were somewhat hampered by water shortages resulting from drought conditions.

PRODUCTION

The estimated value of world crude mineral production in 1980 was $549,300 million in terms of 1978 dollars, an amount that was $11,000 million or 1.9% below the 1979 level, reflecting a downturn in the volume of production of several major commodities. The following tabulation summarizes approximate data on the value of world mineral production for selected years:

Year	Billion constant 1978 dollars	
	Value of 53[1] major crude mineral commodities[2]	Value of all crude mineral commodities[3]
1950	67.8	77.2
1953	88.5	101.7
1958	113.6	136.5
1963	125.7	154.0
1968	145.6	176.5
1973	234.0	281.6
1978	478.9	539.7
1979	497.2	560.3
1980	487.4	549.3

[1]The list of commodities included appears in table 3 of this chapter; one commodity covered in 1950-68 (beryl) is excluded from the 1973-80 figures, but the overall impact of this omission is regarded as insignificant.

[2]Data for all years except 1979 and 1980 are as reported in Annales des Mines, November-December 1980, p. 173; data for 1979 and 1980 are extrapolated from the 1978 Annales des Mines figures on the basis of the United Nations index of extractive industry production in the United Nations Monthly Bulletin of Statistics, August 1981, p. xiv.

[3]Data extrapolated from values for 53 commodities to compensate for other mineral products. For details on the basis for this extrapolation, see accompanying text under "Value of World Mineral Production."

The foregoing data belittle the role of the mineral industry in the world economy, however, by representing only an approximation of the value of crude production from mines, quarries, and wells, rather than the enhanced value that results from

beneficiation, smelting, refining, and other equivalent downstream processing. Moreover, these data do not reflect value added owing to transporting mineral materials from production areas to consuming areas. If the value added through processing—smelting of metals, refining of oil, and manufacture of basic materials such as cement and fertilizers—were included, a 1980 figure on the order of $1,300,000 million (1978 dollars) could be regarded as a conservative estimate of the value of output of primary mineral-processing plants. An additional, unestimated increment should also be added for the value of secondary metals produced. It should be stressed that crude and processed mineral commodities constitute not only the overwhelming dominant share of the total raw material base for all manufacturing endeavors, but also represent a significant requirement for the agricultural industries because of that industry's need for fertilizers of mineral origin, as well as the overwhelmingly dominant source of energy for industry throughout the world and for individual energy requirements in all developed countries and a number of developing countries as well.

PRODUCTION INDEX PATTERNS

The following tabulation summarizes the growth in world mineral industry output as reflected by the United Nations indexes for extractive mineral industry components:

Year	Index numbers (1975=100)			
	Coal	Crude petroleum and natural gas	Metals	Total
1978	101.0	116.1	101.6	112.6
1979	106.1	120.3	104.1	116.9
1980:				
January to March	109.4	121.8	104.7	118.3
April to June	110.7	115.9	105.9	114.9
July to September	107.4	114.6	103.0	112.7
October to December	112.1	112.7	104.2	112.5
Annual	109.9	116.3	104.5	114.6

Source: United Nations. Monthly Bulletin of Statistics. V. 35, No. 8, August 1981, p. xiv.

Particularly notable is the fact that the overall total index number for the first quarter of 1980 exceeded the 1979 average (largely on the strength of the fuels sectors), and that there was a continual decline through the remaining quarters, this due almost entirely to the continued decline in the petroleum and natural gas sector. It was further notable that the modest decline registered for coal and metals in the third quarter was more than compensated by increases in these sectors in the fourth quarter.

Comparison between the world extractive industry indexes in the foregoing tabulation and the indexes for processing sectors of the mineral industry that are presented in the following tabulation reflect the substantially higher unit prices for downstream products as well as the higher profitability of secondary metal production (in the base metal index):

Year	Index numbers (1975=100)		
	Nonmetallic mineral products	Chemicals, petroleum, coal, and rubber products	Base metals
1978	117.3	124.9	114.7
1979	121.4	131.0	119.5
1980:			
January to March	120.4	133.3	122.3
April to June	126.3	131.4	120.4
July to September	121.3	124.3	108.8
October to December	121.4	128.0	114.1
Annual	122.4	129.3	116.4

Source: United Nations. Monthly Bulletin of Statistics. V. 35, No. 8, August 1981, p. xv.

For details on differences in mineral industry index growth patterns for various

geographic areas, see the source publication for the foregoing tabulations.

QUANTITATIVE COMMODITY OUTPUT

Total world production of 95 distinct mineral commodities and/or specific forms of mineral commodities is given in table 1 for 1976-80. Of these commodities, 53 registered gains and 41 recorded declines relative to 1979 output levels (1 commodity registered no change). These figures contrast rather sharply with results comparing 1979 output levels with those of 1978, when 77 commodities showed gains and only 18 registered declines. Of the 50 metallic commodities listed, 28 were produced in greater quantities in 1980 than in 1979, and 22 were produced in lesser quantities, but among those recording declines were iron ore, pig iron, ferroalloys, crude steel, mine copper, smelter copper (both primary and secondary), mine lead, smelter lead (both primary and secondary), refined lead (both primary and secondary), mine silver, mine zinc, and smelter zinc (both primary and secondary)—virtually all major metals save aluminum and its ores and intermediate products.

Among the 34 listed nonmetals, 18 registered gains between 1979 and 1980; 15 recorded declines; and 1 was unchanged, but in contrast to the situation among the metals, several major nonmetallics recorded increases—notably cement, nitrogen, phosphate rock, and sulfur (all 3 listed forms).

Of the 11 fuel commodities listed (not counting uranium, included among the metals), 7 showed increases and 4 registered declines, including, most notably, crude and refined oil.

No viable means exist to sum up the overall production performance of the nonfuel mineral industry except on a value basis, and for these commodities, exactitudes on value are not available for detailed review for 1979 and 1980. Among the fuel commodities, however, a pattern of overall growth can be demonstrated by United Nations data in which all fuels are reduced to a common energy equivalent basis. The following tabulation summarizes world energy material output for 1975-80 (1980 data partly estimated):

Table 1.—World production of major mineral commodities[1]

Commodity and unit of measure	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Bauxite, gross weight[2] thousand metric tons	78,942	83,648	81,431	89,256	91,513
Alumina, gross weight do	27,194	29,643	29,600	31,067	32,983
Unalloyed ingot metal do	12,622	13,786	14,118	14,563	15,368
Antimony, mine output, metal content metric tons	64,762	67,653	60,967	65,266	67,191
Arsenic, white[3 4] do	34,492	31,282	31,219	30,694	28,685
Beryl concentrate, gross weight[3 4] do	2,316	2,540	2,807	2,698	2,810
Bismuth[3] do	3,941	4,403	4,283	3,552	3,323
Cadmium metal, smelter do	16,998	18,250	17,331	18,503	17,716
Chromite, gross weight[4] thousand metric tons	8,493	9,220	9,038	9,535	9,730
Cobalt:					
Mine output, metal content metric tons	21,418	21,484	25,595	28,692	29,905
Metal, refined do	20,349	20,762	24,769	28,227	29,475
Columbium-tantalum concentrates[4 5] do	23,075	21,617	23,574	35,145	35,611
Copper:					
Mine output, metal content thousand metric tons	7,525	7,756	7,633	7,675	7,617
Metal:					
Smelter:					
Primary[6] do	7,322	7,602	7,501	7,494	7,392
Secondary[7] do	518	533	522	566	561
Refined:					
Primary[6] do	7,162	7,454	7,521	7,563	7,660
Secondary[7] do	1,161	1,193	1,268	1,349	1,382
Gold, mine output, metal content thousand troy ounces	39,024	38,921	38,985	38,802	38,882
Iron and steel:					
Iron ore, gross weight thousand metric tons	899,304	841,629	848,767	911,497	887,597
Metal:					
Pig iron do	497,636	489,319	505,952	529,213	507,738
Ferroalloys do	13,807	13,707	14,070	16,182	15,698
Steel, crude do	673,530	670,051	709,921	740,520	707,580
Lead:					
Mine output, metal content do	3,345	3,442	3,579	3,523	3,518

See footnotes at end of table.

Table 1.—World production of major mineral commodities[1] —Continued

Commodity and unit of measure	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Lead —Continued					
Metal:					
Smelter:					
Primary[6] thousand metric tons	3,237	3,227	3,290	3,340	3,262
Secondary do	1,753	1,931	1,938	2,049	1,851
Refined:					
Primary do	3,232	3,196	3,303	3,331	3,243
Secondary do	1,914	2,122	2,123	2,267	2,038
Magnesium metal, smelter, primary[8] metric tons	249,369	257,236	288,654	309,029	318,309
Manganese ore, gross weight thousand metric tons	24,597	22,823	22,537	26,199	26,697
Mercury, mine output, metal content 76-pound flasks	234,614	190,736	181,434	190,039	191,069
Molybdenum, mine output, metal content metric tons	88,666	95,130	100,239	104,047	107,863
Monazite concentrate (source of rare-earth metals and thorium) do	12,052	15,761	22,234	22,353	21,405
Nickel:					
Mine output, metal content thousand metric tons	792	804	660	683	771
Metal, smelter do	742	718	607	686	754
Platinum-group metals, mine output thousand troy ounces	6,228	6,511	6,330	6,486	6,830
Selenium metal, smelter[4 5] metric tons	1,109	1,384	1,421	1,600	1,332
Silver, mine output, metal content thousand troy ounces	316,384	340,262	344,438	345,958	341,370
Tellurium metal, smelter[4 5] metric tons	100	133	157	213	204
Tin:					
Mine output, metal content do	218,412	230,220	241,355	245,318	246,247
Metal, smelter do	224,063	226,450	241,918	246,602	248,104
Titanium concentrates, gross weight:					
Ilmenite[4 9] thousand metric tons	3,166	3,314	3,515	3,512	3,612
Rutile[3 4] do	404	341	302	360	423
Titaniferous slag do	818	694	941	764	1,219
Tungsten, mine output, metal content metric tons	38,066	40,347	43,609	47,042	53,273
Uranium oxide, mine output, U_3O_8 content[4 5] do	28,079	33,343	40,169	44,531	47,533
Vanadium, mine output, metal content do	28,312	30,221	31,043	34,746	35,885
Zinc:					
Mine output, metal content thousand metric tons	5,725	5,945	5,928	5,917	5,761
Metal, smelter:					
Primary[6] do	5,429	5,582	5,670	6,005	5,806
Secondary[7] do	245	223	207	240	230
Zirconium concentrate[3 4 5] do	448	432	448	547	554
NONMETALS					
Asbestos do	4,707	4,793	4,693	4,890	4,818
Barite do	5,205	5,865	6,851	7,126	7,553
Boron minerals do	2,340	2,746	3,130	2,796	2,742
Bromine[4] do	309	301	311	326	347
Cement, hydraulic do	756,854	795,189	852,532	873,817	886,888
Clays:[4]					
Bentonite[5] do	5,012	5,261	5,867	6,147	6,010
Fuller's earth[5] do	1,563	1,674	1,734	1,831	1,771
Kaolin do	17,051	18,282	19,467	21,581	20,839
Corundum, natural metric tons	12,585	17,832	21,827	26,354	26,321
Diamond:[4]					
Gem[e] thousand carats	9,275	10,074	10,253	10,542	10,670
Industrial[e] do	29,583	29,264	29,038	28,471	30,968
Total do	38,858	39,338	39,291	39,013	41,638
Diatomite[4] thousand metric tons	1,433	1,467	1,451	1,509	1,500
Feldspar[4] do	2,797	2,928	3,107	3,431	3,431
Fluorspar do	4,323	4,425	4,659	4,589	4,650
Graphite[3] metric tons	477,093	495,343	528,916	535,941	541,979
Gypsum thousand metric tons	65,846	71,173	76,062	76,341	74,430
Iodine metric tons	11,035	10,599	10,651	11,416	11,455
Lime[4] thousand metric tons	115,855	117,868	120,032	121,722	120,081
Magnesite[3] do	9,061	9,737	9,709	10,783	10,826
Mica[4] do	214	229	251	247	231
Nitrogen: N content of ammonia[10] do	56,878	62,158	65,881	69,770	70,838
Perlite do	1,268	1,365	1,401	1,453	1,444
Phosphate rock and guano do	107,520	116,658	125,912	130,200	134,917
Potash, marketable, K_2O equivalent do	24,281	25,156	26,173	25,933	27,871

See footnotes at end of table.

Table 1.—World production of major mineral commodities[1] —Continued

Commodity and unit of measure	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Pumice[4 5] thousand metric tons	15,037	16,325	17,399	16,338	16,068
Salt do	160,667	160,888	166,428	171,853	164,752
Sodium compounds, n.e.s.:[4]					
Sodium carbonate do	26,082	27,042	27,871	28,702	29,112
Sodium sulfate do	4,462	4,364	4,341	4,460	4,502
Strontium minerals[4 5] metric tons	69,420	95,312	88,616	84,983	74,552
Sulfur, elemental basis:					
Elemental[11] thousand metric tons	17,084	16,476	17,105	17,708	17,710
From pyrite do	9,425	9,675	9,973	10,110	10,149
Byproduct[12] do	24,321	26,181	26,833	27,342	28,171
Total do	50,830	52,332	53,911	55,160	56,030
Talc, soapstone, pyrophyllite do	5,273	5,658	5,974	6,450	6,872
Vermiculite[4 5] metric tons	522,646	520,364	543,064	539,915	528,897
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[4 5] thousand metric tons	3,621	3,653	3,969	4,148	4,227
Coal:					
Anthracite million metric tons	180	188	194	201	203
Bituminous coal do	2,307	2,400	2,443	2,587	2,604
Lignite do	888	901	920	942	965
Total do	3,375	3,489	3,557	3,730	3,772
Coke:[13]					
Metallurgical thousand metric tons	362,134	352,575	356,299	384,261	367,561
Other do	18,205	17,389	13,100	13,177	13,393
Gas, natural, marketed billion cubic feet	47,855	49,618	51,405	54,497	55,550
Natural gas liquids[4] million 42-gallon barrels	1,070	1,102	1,118	1,174	1,206
Peat[14] thousand metric tons	202,325	202,319	203,442	202,471	202,362
Petroleum:					
Crude million 42-gallon barrels	21,089	21,891	22,063	22,916	21,771
Refined do	21,356	22,402	22,526	23,506	22,826

[e]Estimated. [p]Preliminary.

[1]Incorporates numerous revisions from the table corresponding to this table in previous editions of this chapter. Figures generally conform to those published in appropriate commodity chapters of volume I of the Minerals Yearbook, 1980 edition.

[2]Includes bauxite equivalent of nepheline syenite and alunite produced in the U.S.S.R. (the only producer on record of such materials as a source of aluminum).

[3]Excludes data for the United States (withheld to avoid disclosing company proprietary data).

[4]Excludes data for mainland China (no adequate basis for estimation available).

[5]Excludes data for the U.S.S.R. (no adequate basis for estimation available).

[6]Includes all metal clearly identified as primary as well as all metal that cannot be subdivided clearly between primary and secondary (see footnote 7).

[7]Includes only that metal that is clearly identified as secondary. Some countries do not distinguish between primary and secondary and for some of these, no basis is available for estimating the breakdown of total production. For such countries, the total has been included under primary (see footnote 6).

[8]Excludes data for the United States (withheld to avoid disclosing company proprietary data), which in previous years accounted for approximately 50% of the world total.

[9]Includes leucoxene.

[10]Data are for years ending June 30 of that stated.

[11]Comprises sulfur produced by the Frasch process plus sulfur mined in the elemental state from ores.

[12]Comprises sulfur recovered from coal gasification, metallurgical operations (except pyrite processing), natural gas, petroleum, tar sands, spent oxides, and gypsum, whether recovered in the elemental state or as a sulfur compound.

[13]Production of coke other than metallurgical by mainland China and the U.S.S.R. is included with metallurgical coke production.

[14]Of which fuel peat, as follows, in thousand metric tons (balance for agricultural use): 1976—66,450; 1977—66,178; 1978—66,911; 1979—65,326; and 1980—65,228. Unrevised versions of these figures inadvertently were published in the table corresponding to this table in the 1978-79 edition of volume III, Minerals Yearbook.

VALUE OF WORLD MINERAL PRODUCTION

The comprehensive study on value of world mineral production that has been prepared periodically during the past 28 years for the French language monthly mineral industry publication Annales des Mines was extended for another 5-year increment in the November-December 1980 issue of that publication. The series now provides nearly uniform data for the years 1950, 1953, 1958, 1963, 1968, 1973, and 1978. The study fixes the constant 1978 dollar value of total world production of a selected list of crude mineral commodities[3] at $478,917.9 million for 1978, an increase of nearly 105% over the 1978 constant dollar value of output in 1973, equivalent to an annual average increase of 15.4%, which the source publication attributes to a 1.9% annual average increase in volume of out-

put and a 13.3% annual average increase in the inflation-corrected price index for crude minerals. The figures in the French source have been roughly extrapolated by the U.S. Bureau of Mines to cover the full range of crude mineral commodities covered in the Minerals Yearbook on the basis of the share of total U.S. crude mineral output value accounted for by those selected commodities covered by the French source. The data upon which the extrapolations were based are as follows:

Year	Million current U.S. dollars		
	Value of total U.S. crude mineral output	Value of U.S. output of selected minerals covered in Annales des Mines[1]	Percentage of total accounted for by selected commodities
1950	11,835	10,405	87.8
1953	14,382	12,511	87.0
1958	16,526	13,754	83.2
1963	19,620	16,002	81.6
1968	24,974	20,591	82.4
1973	36,788	30,579	83.1
1978	[2]19,821	[2]10,008	[2]50.5

[1]Values as reported by U.S. Bureau of Mines, not as reported in Annales des Mines. Corresponding values as reported in Annales des Mines in million dollars were 1950—$10,406; 1953—$12,435; 1958—$12,440; 1963—$15,742; 1968—$20,232; 1973—$29,876; and 1978—$8,766 (the last excluding fuels for comparability—see footnote 2).

[2]Excluding fuel minerals, no longer the primary responsibility of the U.S. Bureau of Mines, and for which 1978 data corresponding to that for 1950-73 inclusive was not published.

The published figures for total value of world production appearing in Annales des Mines for the selected group of commodities were increased on the basis of the percentages in the right hand column of the foregoing tabulation for each year shown, 1950 through 1973, inclusive. For 1978, where U.S. fuels value data were not available, the French published value for metals and nonmetals only was increased in a similar fashion and then added to the existing French-published fuels value. This method, using the U.S. experience as a basis for the extrapolation to full commodity coverage in order to obtain at least a rough approximation of the latter, even though it is recognized that, in all likelihood, the ratio between (1) the value of commodities included in the French study and (2) the value of commodities excluded from that study is not at all consistent from country to country around the world. The results of this extrapolation appear in the first tabulation under the heading "Production" in a preceding part of this chapter. That tabulation also includes an extrapolation of the Annales des Mines 1978 figure to 1979 and 1980, this extrapolation based on the United Nations index of world extractive industry production.

Year	Million metric tons of standard coal equivalent				
	Coal	Crude petroleum and natural gas liquids	Natural gas	Hydro and nuclear electricity	Total
1975	2,427	3,981	1,583	224	[1]8,214
1976	2,482	4,313	1,645	231	8,671
1977	2,570	4,467	1,685	250	[1]8,973
1978	2,608	4,517	1,743	277	9,145
1979	2,737	4,693	1,843	287	9,560
1980	2,761	4,450	1,857	299	9,367

[1]Detail does not add to total shown because of independent rounding.

Sources: Data for 1975-79 are taken directly from United Nations. Yearbook of World Energy Statistics. New York, 1981, p. 2; data for 1980 are extrapolations of 1979 United Nations figures based on data collected by U.S. Department of Energy and published in 1980 International Energy Annual. Washington, D.C., 1981, pp. 14, 18, 20, 22, and 24.

GEOGRAPHIC DISTRIBUTION OF WORLD MINERAL OUTPUT VALUE

Available information is inadequate to extrapolate to 1980 the 1978 data on the geographic distribution of world mineral output published in Annales des Mines. However, those data, together with corresponding data for 1973 and 1950, are presented in table 2 of this chapter to demon-

strate the shifts in relative importance of the various countries, particularly the changes that occurred during the 1973-78 period.

The most notable change was the U.S.S.R.'s move into first place, displacing the United States. The U.S.S.R., with 19.89% of the 1978 world total value, not only displaced the United States, but also continued to increase its share of the world total; while, in contrast, the U.S. share of the total again diminished as it has with each periodic study (1953, 1958, 1963, 1968, and 1973) since the first, made in 1950, when the United States accounted for 39.31% of world output value. Saudi Arabia firmed its position as the third-ranked nation, increasing its share of the total from almost 5.7% in 1973 to 8.2% in 1978; similarly, both fourth-ranked mainland China and fifth-ranked Iran firmed up their positions, registering higher shares of the total in 1978 than in 1973. In contrast, Canada retained sixth rank in 1978, but accounted for a smaller share of the year's total than it did of the 1973 total. As a result of oil output from the North Sea fields, the United Kingdom moved markedly higher in 1978, rising from 13th rank in 1973 (1.76% of total) to 7th rank in 1978 (2.58% of total), reattaining the ranking that it held in 1968, which was based very largely on its coal output. Iraq, ranking 8th in 1978, also registered a substantial improvement in its position (17th in 1973); 9th-ranked Libya was unchanged in position since 1968; and rounding out the leading 10 1978 producers, Venezuela, with declining oil output, fell from 7th rank in 1973.

The significance of crude oil as the principal factor in national rankings is evidenced by the fact that of the 10 leading countries in value of world mineral output in 1978, only two—Canada and the United Kingdom—were not among the 10 leading oil producers in that year, and these 2 ranked 13th and 16th, respectively, as crude oil producers in that year. The growth in the significance of oil is also demonstrated by the decline in rank of the Republic of South Africa, 8th in 1963, 10th in 1968 and 1973, and 17th in 1978, for throughout this time, the Republic has shown substantial growth on a quantitative basis in output of a number of significant nonfuel minerals as well as in coal.

Despite the changes in ranking, however, it is perhaps significant to note the consistency of ranking for leading countries. Of the 20 leading nations in crude mineral output value in 1978, 13 held a rank of 20 or higher since 1963 (the U.S.S.R., the United States, Saudi Arabia, mainland China, Iran, Canada, the United Kingdom, Iraq, Venezuela, the Federal Republic of Germany, Kuwait, Poland, and the Republic of South Africa), and 4 more were among the top 20 in 3 of the 4 surveys (Libya, Australia, and Algeria in 1968, 1973, and 1978; and Mexico in 1963, 1968, and 1978).

The following tabulation summarizes the changes in distribution of total world crude mineral output value in terms of major groups of countries:

Country group	Share of total world value of listed commodities		
	1950	1973	1978
Market economy countries:			
Developed	67.46	36.19	30.20
Developing:			
Organization of Petroleum Exporting Countries (OPEC)	9.98	27.04	30.56
Other	5.99	9.75	9.69
Centrally planned economy countries	16.57	27.02	30.55

The most notable trends are the decline in the share of total accounted for by developed market economy countries, the nearly parallel growth in share of total accounted for by the developing Organization of Petroleum Exporting Countries (OPEC) and the centrally planned economy countries, and the at first increasing and then declining share of total accounted for by non-OPEC developing market economy nations.

Examining the 1978 total from the viewpoint of continental distribution, Asia (less Asiatic U.S.S.R.) accounted for the largest single segment, 32% (including 21.1% for the Near East, 7.1% for mainland China and other centrally planned economy countries of Asia, and 3.8% for Japan and other market economy nations of the Far East). The U.S.S.R. and the other centrally planned economy nations of Europe collectively provided 23.5% of the total; Canada and the United States together supplied 18.5%; Africa accounted for 9.6%; market economy Europe was the source of 8.3%; Latin America contributed 6.4%; and the remaining 1.7% was from Oceania.

COMMODITY DISTRIBUTION OF WORLD MINERAL OUTPUT VALUE

As in the case of the geographic distribution of world mineral output value, the inadequacy of data precludes any reliable extrapolation of the various commodities'

shares of the totals published for 1978 in Annales des Mines to 1979 or 1980. Therefore, the commodity breakdown in that source for 1978 has been included in this chapter as table 3, to provide the most recent reliable measurement of the relative value of the various mineral commodities.

The growing preeminence of the fuel minerals is immediately evident: Crude oil alone accounted for 55.57% of the 1978 total of the reported commodities (47.44% in 1973); crude oil together with anthracite, bituminous, and lignite coal, natural gas, natural gas liquids, and uranium accounted for 87.05% of the total value of listed commodities in 1978 (76.98% in 1973).

The following tabulation summarizes the shares of total value of listed commodities accounted for by each of the major commodity groups:

Commodity group	Percent of value of all listed commodities				
	1950	1963	1968	1973	1978
Mineral fuels	76.43	76.62	72.91	76.98	87.05
Metals	19.18	17.98	20.96	18.64	9.32
Industrial nonmetals	4.39	5.40	6.13	4.39	3.63

At this point, it should be noted that had the Annales des Mines staff had available to them comprehensive worldwide data on the mineral commodities mentioned previously in the section of this chapter on value of world mineral production, and had such data been included in this study, the shares reported for mineral fuels and metals would be marginally lower than those given, while the share reported for industrial nonmetals would probably more than double. Thus, the foregoing data array tends to belittle the significance of nonmetallics and somewhat overstates the relative importance of fuel minerals and metals as a result of incomplete data.

Among individual nonfuel commodities, probably the most significant changes between 1973 and 1978 were (1) the higher ranking of iron ore (up to 4th from 5th); (2) the decline of copper (from 4th to 6th); (3) the rise of phosphate rock (from 16th to 9th); (4) the decline of lead (from 11th to 16th); (5) the decline of zinc (from 9th to 16th); and (6) the decline of nickel (from 10th to 20th).

TRADE

In 1979, the aggregate value of total world trade in mineral commodities reached an estimated $473,341 million (current dollars), a very substantial increase (42.5%) above the previous record high set in 1978. Comparable data for 1980 were not available in time for inclusion in this chapter; available information clearly suggested a significant increase, but in all likelihood a much less substantial increase than that between 1978 and 1979. At this writing, data were far too sparse to provide a basis for a reasonable estimate of the percentage growth. The following tabulation summarizes the growth pattern in mineral commodity trade for 1975-79, as well as the role of that trade in total commodity trade:

Year	Estimated value of all mineral commodities traded (millions)	Change from previous year (percent)	Mineral commodities share of all commodities traded (percent)
1975	r$312,400	-3.8	35.8
1976	r353,200	+13.1	35.7
1977	385,900	r+9.3	r34.3
1978	r407,500	r+5.6	r31.4
1979	508,800	+24.9	35.4

rRevised.

The huge gain was due, in substantial part, to the inflationary spiral, particularly advances in the unit prices for oil, but the increased level of industrial activity, reflected as previously mentioned, in 1979 production levels for many commodities, contributed also. Although 1980 data are not yet available, the growth in trade will undoubtedly reflect the cutbacks in output of those major volume commodities, such as iron ore and crude oil.

Table 4, which served as the basis for the estimates of total mineral commodity trade appearing in the foregoing tabulation, provides reported data on the value of trade in major mineral commodity groups and total commodity trade for 1975-79. Table 5 shows the percentage share of major mineral commodity groups in the total trade of these commodities for 1975-79 and table 6 provides individual growth (or decline) rates for each of the major mineral commodity groups for the same years.

Major mineral commodity trade by region (such as tables 8-10 in the 1976 edition of this chapter) may be obtained for 1965, 1970, and 1975-79 directly from the United Nations Monthly Bulletin of Statistics for May 1981.

CONSUMPTION

NONFUEL MINERAL COMMODITIES

Virtually worldwide cutbacks, or at the very least stagnation in downstream industrial growth in 1980, were reflected in available statistics on consumption of metallic commodities in 1980. The following tabulation, which provides data on estimated world use for seven prominent nonferrous metals for recent years, clearly demonstrates this drop:

Commodity	Thousand metric tons				
	1976	1977	1978	1979	1980
Aluminum, primary refined	14,076	14,511	15,334	15,963	15,245
Cadmium	18	16	16	18	17
Copper, refined[1]	8,539	9,078	9,502	9,838	9,526
Lead refined[1]	5,094	5,401	5,463	5,566	5,288
Nickel[2]	670	642	697	779	718
Tin refined[1]	239	231	231	232	224
Zinc, slab[1]	5,674	5,825	6,150	6,327	6,069

[1]Primary and secondary combined.
[2]Nickel content of refined nickel, ferronickel, and nickel oxide.

Source: World Bureau of Metal Statistics. World Metal Statistics. V. 34, no. 9, London, Sept. 17, 1981, pp. 12, 33, 38, 73, 87, 97, and 101.

The seven commodities listed registered an unweighted average consumption decline of 4.8% between 1979 and 1980 (weighted average consumption was down 4.2%). The individual commodity declines resulted in consumption levels below those of 1979 but above those of 1978 for cadmium, copper, and nickel, below those of both 1978 and 1979 but above the 1977 level for aluminum and zinc, a lower level for lead than in any year since 1976, and a lower level for tin than in any year since 1975.

Regarding the ferrous metals, less current and less complete data are available; nonetheless, the downturn in 1980 was clearly evident. A total world decline in iron ore consumption of 5% or more was indicated and a decline in the use of iron and steel scrap of 4% to 5% comparing 1980's level to that of 1979 seemed likely on the basis of partial returns. Despite an increase in output of manganese ore, a decline in the consumption level of 3% to 5% seemed likely.

Considering major nonmetallic commodities, the small growth in total world cement output (1.5%) was evidently, at least in part, utilized; thus, cement consumption evidently edged marginally upward, running counter to the trend in metals. Among the fertilizer commodities, consumption of nitrogenous and phosphatic materials continued to increase through the end of the crop year 1980 (July 1, 1979, to June 30, 1980), while that of potassic fertilizers edged downward slightly as shown in the following summary tabulation:

Commodity	Crop (ending June 30 of year stated)		
	1978	1979	1980
Nitrogenous ---------- million metric tons N	49.8	53.8	57.0
Phosphate ---------- million metric tons P_2O_5	27.9	29.9	31.2
Potassic ---------- million metric tons K_2O equivalent	23.0	24.5	23.5

Source: British Sulphur Corp. Ltd. Statistical Supplement No. 22, January-February 1981, London, p. 1.

Data on worldwide sulfur consumption for 1980 are incomplete, but a slight increase over the level of 55.5 million tons of sulfur in all forms estimated by British Sulphur Corp. was expected. The 1979 level was 5.1% above their estimated 1978 level and 11.4% above their estimated 1977 level.

MINERAL FUEL COMMODITIES

On a worldwide basis, energy consumption in 1980 fell by an estimated 2.3% relative to the 1979 level, compared with a 3.7% growth registered between 1978 and 1979. Thus, the overall world energy consumption level in 1980 was nearer that of 1978 than that of 1979. The entirety of the decline was the result of diminished use of petroleum, as shown in the following tabulation, which summarizes world energy consumption subdivided by major fuel types for 1975-80:

Year	Million metric tons of standard coal equivalent				
	Solid fuels	Liquid fuels	Natural gas	Hydro and nuclear electricity	Total
1975	2,397	3,348	1,561	223	7,529
1976	2,476	3,578	1,645	231	7,930
1977	2,560	3,692	1,666	250	8,168
1978	2,612	3,768	1,738	277	8,395
1979	2,738	3,834	1,846	288	8,706
1980[e]	2,750	3,600	1,855	298	8,503

[e]Estimated.

Source: Data for 1975-79 are taken directly from United Nations Yearbook of World Energy Statistics. New York, 1981, p. 3; data for 1980 are estimates by senior author.

The tabulation reflects the modest advances in worldwide use of coal, natural gas, and hydro- and nuclear-generated electric power in sharp contrast to the decline in liquid fuels (chiefly petroleum refinery products, but also including natural gas plant-derived liquefied petroleum gas and so-called natural gasoline). As a result of these changes in consumption levels, solid fuels accounted for over 32.4% of total energy in 1980 (31.5% in 1979), liquid fuels for 42.3% in 1980 (44% in 1979), natural gas for 21.8% in 1980 (21.2% in 1979), and hydro- and nuclear-generated electricity for 3.5% in 1980 (3.3% in 1979).

INVESTMENT

Data published by the U.S. Department of Commerce relating to U.S. foreign investment in mineral industry activities show continued growth in both petroleum and mining-smelting-refining from 1978 through 1980, but the gains, reported in current dollars, would be considerably reduced if they were deflated to adjust for the inflation rate.

Unfortunately, reasonably comprehensive data on worldwide mineral industry activity are not available for 1980, and for 1979, such figures are available for only a few geographic and commodity areas. Table 7 shows steel industry investment data for nations of the Organization for Economic Cooperation and Development, showing a substantial downturn in 1979, almost entirely as a result of a dramatic drop in the Japanese investment level (although the

European Economic Community (EEC) as a whole registered a slight drop, as did Australia and Spain).

Information on Brazil's extractive mineral industry investment for 1980 indicated a total level equivalent to $660 million, including $240 million for phosphates, $120 million for iron ore, $110 million for nickel, $70 million for copper, $60 million for kaolin, and $60 million for expansion and improvement of existing iron ore mines and related facilities. Clearly these expenditures were for major projects only and exclude much downstream processing, but it is indicative at least of activity in what is one of the more stable Latin American investment areas. A somewhat more modest extractive industry investment level was reported for the Republic of South Africa—a level equivalent to $402 million, of which the largest share was for new gold production facilities, a substantial amount of the remainder for new uranium projects, with small amounts for new chromite facilities and improvement of existing tin facilities. Investments of $435 million in Greece in 1980 were chiefly for new bauxite and nickel facilities.

Worldwide petroleum industry investment for 1980 had not been summarized at the time of this writing, but particulars for 1979 are provided divided on a regional basis in table 8 and on a worldwide basis divided by the various sectors of the industry in table 9. Table 10 provides data on U.S. direct foreign investment in mineral industry activities (mining, smelting and refining, and petroleum) for 1977-80, with regional detail of the last 2 years of the period.

TRANSPORTATION

MARINE TRANSPORT

Tankers, bulk carriers, and freighters are the three classes of vessels engaged in transporting mineral commodities. The number, gross tonnage, and deadweight tonnage of these vessels, as well as similar data for other vessels of the world's merchant fleet, as reported by the U.S. Maritime Administration for 1975-79, are given in table 11.

It should be noted that vessels in each of the three categories are not devoted wholly to mineral commodity transport. Tankers, although largely engaged in moving crude oil and refinery products, also transport liquid chemicals, wine, molasses, and whale oil. Bulk carriers move agricultural products as well as crude minerals and mineral fertilizers, while freighters, because of their great variety, can be devoted wholly to hauling mineral products or wholly to moving nonmineral goods, as well as to carrying mixed mineral and nonmineral cargos.

Table 12 gives information on total loadings and unloadings of vessels, divided between tanker-type cargo and dry cargo, for the years 1975-79. Although it is recognized that these figures on loadings and unloadings include goods other than minerals, they nevertheless serve as a reasonable measure of mineral commodity shipments, because the preponderance of total weight of all goods moved is accounted for by minerals. Some measure of the significance of mineral commodity movement to total commodity movement is apparent in data for the world's two major canals, the Panama and the Suez, and it should be noted that figures for these waterways are skewed in favor of nonmineral commodities by both waterways' inability to handle large supertankers and bulk cargo vessels engaged in ore trade. Although exact recent figures are not available, it appears likely that minerals and mineral products account for three-quarters or more of total cargo carried in any single year on a weight basis.

Tables 13 and 14 provide a geographic breakdown of loadings and unloadings of dry cargo and tanker cargo, respectively, for 1977-79 on a tonnage basis. Again recognizing that both tables include mineral and nonmineral goods, but also recognizing the dominance of mineral materials from the viewpoint of tonnage, these tables give some idea of the relative importance of various world areas as origins and destinations for mineral materials.

Although physical characteristics of vessels—size, draft, age, crew requirements, type of propulsion system, etc.—as well as fuel costs have an undeniable influence on shipping industry performance, problems of and changes in the quantity and type of material being moved also significantly affect the shipping sector of the world economy. Therefore, before detailing changes in composition of the merchant fleet that serves the mineral industry, some observations on major mineral cargoes seem in order. First in importance because of the volume of material moved was oil, and in

this case, preliminary figures indicated an 8.4% decline in total movement of crude oil and oil products relative to 1979 levels. The total of 1,665 million tons included 1,420 million tons of crude and 245 million tons of products and represented the lowest overall level of oil shipment since 1975.

The decline in transport performance was even more marked. Haul length in 1980 was 5,750 miles, down from 5,850 miles in 1979. This can be attributed to three factors. First, there was an increase in short-haul crude movements. Second, there was a reduction in use of the Persian Gulf region working in tandem with increased use of the Suez Canal. Third, erratic growth in export movements of Middle East oil from the eastern Mediterranean increased.

A major factor in the changes in world oil trade practices and patterns was the internal economic disorder in Iran that prevailed through the early months of the year as the Khomeini regime took control, and that was heightened by the outbreak of open warfare between Iran and Iraq in the fall. These political and military conditions produced a significant drop in secure long-term oil supplies and intensified competition for potentially available supplies from other producers. At least momentarily, the quest for supply assurance rather than strict price considerations became a dominant consideration. However, as demand levels for oil diminished as a result of both conscious planning at energy conservation and cutbacks in use resulting from general industrial slowdowns in many nations, it became evident that adequate reasonably assured supplies of crude oil were available from producers other than Iran and Iraq.

Another mineral commodity with considerable significance to seaborne transport was phosphate rock. Preliminary 1980 statistics indicate that total seaborne trade of phosphate rock was around 49 million metric tons, the highest level yet recorded. Demand was relatively high during the first half of 1980, dropped slightly as a result of price increases during the third quarter, but rebounded in the fourth.

The United States, Jordan, Morocco, the Republic of South Africa, and Israel were the primary phosphate rock exporters in 1980. About 33% of total U.S. phosphate rock exports went to Europe with the remainder sent to Japan and to South and East Asia. Jordan's primary export markets were Poland, Romania, and Yugoslavia. Morocco, the world's leading phosphate rock exporter, experienced a 1.5% drop in exports owing to reduced demand by Latin American nations.

Because of the large volume of trade between North Africa and Europe, phosphate rock shipments of a short-haul nature remained unchanged. About 62% of total seaborne phosphate rock trade was moved by bulk carriers over 18,000 deadweight tons, and 85% was carried by ships below 40,000 deadweight tons. Only 2% of all shipments were made by vessels over 10,000 deadweight tons, indicating the continued inability of the phosphate rock trade to utilize large bulk carriers, which stems from the nature of port facilities in phosphate rock loading areas.

Bauxite and alumina also were among the mineral commodities accounting for substantial seaborne trade; preliminary statistics indicate total shipments of these materials in 1980 approached 47 million metric tons, of which 30% was alumina. Of the total, Australian exports accounted for nearly one-third, West African shipments for about one-fourth, Caribbean shipments for another one-fourth, and Guyana-Suriname-Brazil shipments for about one-sixth. Roughly 60% of the total bauxite-alumina shipped by sea was moved in vessels below 40,000 deadweight tons, with about 20% moving in vessels of 40,000 to 80,000 deadweight tons and the remainder in vessels of 60,000 to 80,000 deadweight tons. The average haulage distance for vessels in the bauxite-alumina trade was only about 3,700 miles, this as a result of the relatively large volume of material shipped over the relatively short distance from the Caribbean and northern South America into the United States and Canada.

Owing to long-term freight contracts, of which over 90% of all 1980 maritime iron ore trade was conducted, the first half of 1980 saw a surge in seaborne iron ore movements. This increase diminished during the second half of the year as importers utilized their contractual option to reduce shipments to avoid excessive inventories.

Total iron ore shipments amounted to about 310 million metric tons in 1980, 17 million metric tons below the 1979 level but 25 million metric tons above the 1975-78 annual average. Accounting for more than 80% of the export segment of this total were Australia, Brazil, the Republic of South Africa, Liberia, Sweden, India, and Canada. On the demand side, 85% of the iron ore was imported by principal steel producers,

EEC, Japan, and the United States. Other Western European countries, nations of the Far East, and mainland China took the remaining 15%. The average haul length in 1980 was 4,870 miles, unchanged from that of 1979, with over 50% of the total seaborne movement carried in vessels above 100,000 deadweight tons.

There was a sharp upturn in demand for steam coal in 1980, a direct result of that commodity's better competitive position vis-a-vis oil, both from the viewpoint of price and the viewpoint of assurance of supply. One result was the record seaborne movement level of 172 million metric tons, 8.2% over the 1979 level.

In terms of seaborne movements, North America was the leading regional coal exporter. Following were Eastern Europe, Australia, the Republic of South Africa, and Western Europe. Shipments from Australia fell off severely in 1980 owing to labor problems. Most prominent among these was a 10-week strike staged by Queensland coal workers. The reduced Australian shipments resulted in a large increase in seaborne coal exports from the United States and the Republic of South Africa.

With regard to the United States, exports of steam and metallurgical coal shipped reached an estimated 75 million metric tons in 1980, reflecting a near doubling in sales during the period 1978-80. Of the 75 million metric tons, steam coal represented 20% compared with 5% in 1979. The other 80% was of metallurgical quality.

South African total seaborne coal exports increased 14% to 25 million metric tons; 18 million metric tons of this amount went to the EEC nations, reflecting a 30% increase over the 1979 level.

Bulk Carriers.—In 1979, the world's bulk carrier fleet increased by 63 vessels, compared with a 281-vessel decrease in 1978. The 1979 growth represented a 13% gain on the basis of number of vessels. There was a 1% decrease in the average gross tonnage and deadweight tonnage of such vessels, reversing a trend prevalent for a number of years. In 1979, the average bulk carrier grossed 22,346 tons and had a deadweight tonnage of 38,676, compared with 1978 figures of 22,423 and 38,795, respectively. Toward the end of 1979, orders for new bulk carriers increased, and that trend continued through the end of 1980.

The following tabulation shows the distribution of the world bulk carrier fleet by country of registry for 1979:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	920	44,729
Japan	500	21,814
Greece	857	15,026
United Kingdom	236	11,459
Norway	163	10,779
Panama	369	9,350
Italy	149	7,508
India	105	4,462
U.S.S.R.	156	3,106
Germany, Federal Republic of	49	2,886
France	50	2,869
China, mainland	85	2,839
Singapore	82	2,683
Brazil	39	2,405
Spain	68	2,261
Poland	78	2,048
Sweden	31	1,320
Other	777	34,775
Total	4,714	182,319

Freighters.—In 1979, the world's freighter fleet increased by only 188 vessels, a 1.3% increase. In terms of total gross tonnage and deadweight tonnage, there were 2.2% increases over the 1978 levels. The average freighter in 1979 had a gross weight of 6,256 tons (6,202 tons in 1978) and a deadweight tonnage of 8,409 tons (8,341 tons in 1978), a modest increase when the number of vessels involved is considered. The following tabulation shows the distribution of the world's freighter fleet by country of registry in 1979:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Greece	1,564	15,042
Panama	1,666	12,766
U.S.S.R.	1,828	10,996
Japan	756	6,838
United States	469	6,723
Liberia	567	6,357
United Kingdom	514	5,387
China, mainland	462	4,665
Singapore	458	4,042
Germany, Federal Republic of	386	3,946
India	221	2,599
Netherlands	357	2,481
Cyprus	404	2,302
Norway	192	1,944
Other	4,485	34,406
Total	14,329	120,494

Tankers.—In 1979, the world's tanker fleet was 27 vessels greater than that of 1978. The average vessel's gross tonnage declined from 34,849 tons in 1978 to 34,815 tons in 1979, and deadweight tonnage similarly declined, from 65,885 tons in 1978 to

65,756 tons in 1979.

Accounting for the lack of growth in the world's tanker fleet in 1979 was the meager 2.5% increase in transport demand, relative to 1978. This was the result of a 1.5% decline in average haul length caused by the increased use of crude oil pipelines and by the higher level of oil exported by countries outside the Middle East.

Haul length continued to diminish into and throughout 1980 and, coupled with the aforementioned 8.4% drop in oil tonnage carried, effected a significant increase in the number of tankers scrapped. Noteworthy is the fact that, among the 1980 scrappings, 25 ships were of the large crude carrier size (over 150,000 deadweight tons), resulting in a loss of about 3.66 million deadweight tons. Consequently, deadweight tonnage for this tanker class fell 2.2% in 1980.

The following tabulation distributes the world's tanker fleet by country of registry for 1979:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	887	107,569
Japan	487	32,506
Norway	254	26,703
United Kingdom	348	25,018
Greece	395	22,002
United States	307	15,784
France	124	14,961
Panama	273	12,894
Italy	234	9,323
Spain	122	8,925
U.S.S.R.	470	7,349
Germany, Federal Republic of	64	5,644
Singapore	116	5,564
Denmark	72	5,429
Netherlands	62	4,611
Sweden	65	4,220
Other	980	37,378
Total	5,260	345,880

OCEAN FREIGHT RATES

In 1980, two separate patterns emerged relating to ocean freight rates. On the one hand, tanker rates fell significantly when compared with those of 1979. Among the reasons for this were cutbacks in OPEC oil production, reduced consumption resulting from the implementation of conservation policies by many nations and from high oil prices, and a reduction in long-haul crude oil shipments.

On the other hand, 1980 rates for dry cargo increased considerably. At least two factors were responsible for this. First, there were a number of port strikes as, for example, at New South Wales, Australia, where work stoppages and slowdowns were frequent throughout 1980. Second, the strong demand for coal and iron ore, as well as for other mineral and nonmineral commodities, and the concomitant increase in bulk carrier demand placed considerable stress on numerous ports around the world, the facilities of which were incapable of handling the increased shipping loads.

Specific indices for 1980 ocean freight rates may be found in the March, June, and September issues of the 1981 United Nations Monthly Bulletin of Statistics.

PANAMA AND SUEZ CANALS

Owing to the significantly higher level of crude oil and coal shipments passing through the Panama Canal, 1980 was a landmark fiscal year (ending September 30) for the Panama Canal Company. The following table indicates the general traffic condition of the canal, both in terms of the number of vessels transiting the canal and in terms of the amount of cargo moved. Included are mineral commodities and other commodities:

	Fiscal year[1]		
	1978	1979	1980
Number of transits:			
Commercial ocean traffic	12,677	12,935	13,507
Other traffic	1,131	1,427	1,218
Total	13,808	14,362	14,725
Cargo moved (thousand metric tons):			
Commercial ocean traffic:			
Mineral commodities	83,614	90,082	99,481
Other commodities	61,191	66,503	70,418
Subtotal	144,805	156,585	169,899
Other traffic	304	370	403
Total	145,109	156,955	170,302

[1]Year ending September 30 of that stated.

Shipments of petroleum and petroleum products accounted for 28.3% of all cargo shipments. The sharp rise in Alaskan North Slope (ANS) crude oil shipments moving through the canal accounted for a 10.6% increase over that of the previous year in the level of shipments for total canal seaborne movement of the commodity group. ANS crude petroleum shipments totaled 22.5 million metric tons, reflecting a 40% increase over that of 1979. In 1980, 35.9 million metric tons of crude petroleum moved through the canal, 5.4 million metric tons more than the amount shipped in 1979. Shipments of petroleum products amounted to 12.2 million metric tons in 1980, reflecting a decline of 6.8% relative to those of 1979.

In 1980, 17.3 million metric tons of coal and coke were carried through the Panama Canal, an increase of 22.3% over that of 1979 and the highest shipment level in 5 years. The aforementioned Australian coal strike was, in large part, responsible for the rise, as shipments from the U.S. east coast to Japan increased in order to satisfy Japanese demand for coal.

Iron and steel semimanufactures were the largest nonfuel mineral commodity class carried, accounting for 10.2 million metric tons.

The following tabulation distributes mineral commodity trade through the canal during 1978-80 by major group:

Commodity group	Thousand metric tons		
	1978	1979	1980
Metals:			
Ores and concentrates:			
Bauxite	1,414	1,184	1,243
Chromite	134	160	107
Copper	696	508	634
Iron	1,600	1,163	1,748
Lead	117	144	136
Manganese	314	485	625
Tin	63	55	50
Zinc	685	739	664
Other and unspecified	1,383	1,524	2,013
Total	6,406	5,962	7,220
Ingots and semimanufactures:			
Aluminum	100	280	328
Copper	838	895	1,003
Iron and steel [1 2]	11,478	10,763	10,173
Lead	147	120	78
Tin[1]	160	141	94
Zinc	157	98	143
Other	244	234	217
Total	13,124	12,531	12,036
Nonmetals:			
Borax	465	462	466
Cement	369	309	177
Clays, fire and china	266	423	416
Fertilizers	8,059	9,350	9,953
Salt	853	931	713
Sulfur	1,277	1,481	2,380
Other[3]	398	798	511
Total	11,687	13,754	14,616
Mineral fuels:			
Carbon black	84	154	182
Coal and coke	11,093	14,111	17,281
Petroleum:			
Crude	32,843	30,478	35,911
Refined	8,377	13,092	12,235
Total	52,397	57,835	65,609
Grand total	83,614	90,082	99,481

[1]Tinplate is included under tin in source publication.
[2]Includes a category identified simply as "scrap" in source publication, which may include scrap other than iron and steel scrap.
[3]Includes slag, clinkers, and dross.

For greater detail on mineral movements through the Panama Canal, the reader is directed to the Panama Canal Company Annual Report series.

At the Suez Canal, a total of 20,363 vessels transited the canal in 1979, a decrease of 903 vessels relative to 1978 transits (down 4.2%), but in contrast, the tonnage passing through the waterway increased from 248,260,000 tons to 266,171,000 tons (up 7.2%). Of the total number of vessel transits, tankers accounted for 2,698, a figure 8.4% above that of 1978. The net tonnage credited to tankers increased by 16.7% from 73,924,000 tons in 1978 to 86,278,000 tons in 1979. The following tabulation indicates the distribution of tankers by number, direction, net tonnage, and status (loaded or in ballast):

Direction	Number		Net tonnage (thousand metric tons)	
	1978	1979	1978	1979
Southbound:				
In ballast	1,049	1,026	48,176	55,913
Laden	400	518	4,792	6,867
Total	1,449	1,544	52,968	62,780
Northbound:				
In ballast	198	304	2,106	3,886
Laden	842	850	18,850	19,612
Total	1,040	1,154	20,956	23,498

Freighters ranked next after tankers in terms of number of transits and net tonnage, with bulk carriers following in third rank. The following tabulation summarizes transits by these vessel classes:

Vessel class	Number		Net tonnage (thousand metric tons)	
	1978	1979	1978	1979
Freighters:				
In ballast	2,180	1,678	11,049	8,422
Laden	9,541	8,884	63,472	60,958
Total	11,721	10,562	74,521	69,380
Bulk carriers:				
In ballast	386	343	5,282	5,673
Laden	2,127	2,050	31,501	30,717
Total	2,513	2,393	36,783	36,390

Source: Suez Canal Authority.

In terms of goods transited in a southbound direction on the Suez, 81,919,000 tons were shipped in 1979, a 2.2% increase over the 1978 figure of 80,128,000 tons. Of the 1979 total, oil and oil products totaled 8,970,000 tons, an 86.3% increase over the 1978 figure of 4,816,000 tons. This increase was due to a doubling in the quantities of kerosine and diesel oil. In 1979, 916,000 tons of metal and ores were carried southbound through the Suez, a 42.1% drop from the 1978 level of 1,581,000 tons. Southbound coal shipments transiting the Suez amounted to 192,000 tons in 1979, compared with 272,000 tons in 1978.

With regard to northbound movement of commodities through the Suez, 78,730,000 tons were carried in 1979, a 13.1% increase over the 1978 figure of 69,597,000 tons. Of the total northbound 1979 commodity volume, crude oil and oil products accounted for 27,284,000 tons or 34.7%. This constitutes a 3.8% decline from the 1978 figure of 28,363,000 tons. Northbound metals and ores moved on the Suez increased from 7,203,000 tons in 1978 to 9,906,000 tons in 1979, a surge of 37.5%. Finally, whereas 1,543,000 tons of northbound coal and coke

transited the Suez in 1978, 2,201,000 tons did so in 1979.

PIPELINES

Limitations of time and space preclude a comprehensive assessment of international pipeline activities. Major projects in individual countries are treated within the individual country chapters.

PRICES

Comprehensive data on world prices for crude minerals and mineral products are not available; tables 15, 16, and 17 summarize major nonferrous metal prices in the United States, the United Kingdom, and Canada, respectively, for 1977 to 1980, inclusive, with monthly data provided in each case for 1979 and 1980. The general upward trend of 1978-79 for these metals in all three markets that was noted in the previous edition of this chapter was clearly broken in 1980. Aluminum registered a modest increase across the year in the United States, while generally trending downward across the year on the London market. Copper prices reached record peaks in all three markets in February of 1980 and thereafter generally turned downward, with a brief sharp upturn in July, and as the year closed, fell to levels below the 1979 average. Lead prices generally trended downward from January 1980 until August or September when there was a brief upturn, followed again by declines through yearend. Lead's comparison metal, zinc, recorded increases generally in the first quarter, followed by declines until July or August, and then modest upturns through yearend (except in London, where there was a sharp decline in December). Tin prices in both the United States and London reached their 1980 high in March and then, with some minor fluctuations, trended gradually lower until December, when they dropped very sharply in both markets.

In the case of silver, January 1980 was the month of the record silver price within any recent period of history, with the monthly average price topping $38 per troy ounce in all three markets. The decline set in February, although the monthly average for that month in all three markets still topped $30 per troy ounce, then moved down to little better than $24 in March, $14 to $15 in April, and $12 to $13 in May. During June to October, silver prices again edged up to a little above $20 per ounce, but then fell again in the last 2 months. Although there is no detailed presentation in this chapter on the fluctuations in the price of gold, it is worthy of note that on January 21, 1980, the price of gold reached a record high on reputable world markets for recent historical time—$875 per troy ounce in New York. As with the illogically high silver prices of early 1980, however, the decline rapidly set in and by March was under $500 per ounce, a level that was touched again briefly in late summer.

Some approximations of oil prices appear in the U.S. Department of Energy's 1980 International Energy Annual. That publication lists 15 types of crude oil for which it quotes prices as of January 1. At the start of 1980, these prices ranged from a low of $25.20 per barrel for one Venezuelan crude to a high of $34.50 per barrel for a Libyan crude; as of January 1, 1981, the selling price for the Venezuelan crude had been increased nearly 30.5% to $32.88 per barrel, and the Libyan crude, still the most costly, increased 18.2% to $40.78 per barrel. The smallest increase for any of the crudes listed was a 19.6% growth for an eastern Ecuadorian crude oil, but its price was already very high at the start of the year. Crude oils from Nigeria, Algeria, and the United Kingdom all showed price increases during 1980 exceeding 30%. Readers interested in greater detail on crude oil prices and/or in information on foreign petroleum refinery product prices are referred to the aforementioned Department of Energy publication.

STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR MINERAL COMMODITIES

The final 24 tables of this chapter (tables 18-41) extend the statistical series on production that was started in the 1963 edition of the International Area Reports volume of the Mineral Yearbook and was subsequently updated and expanded in the 1965 and

1967-79 editions. They are primarily a supplement to other statistical data within this chapter, but also serve as a summary of international production data for major mineral commodities covered in greater detail, on a commodity basis, in volume I of the 1976 Minerals Yearbook and on a country basis in the balance of volume III.

In this edition, the data presented in these tables, in most instances, correspond with the data in the individual commodity world production tables appearing in volume I and may differ somewhat from a total that might be obtained by adding figures presented for any single commodity in each of the country chapters of volume III. This apparent disparity results from problems of scheduling compilation of tables in the numerous commodity and country tables in the two volumes. In an effort to provide the user with the most up-to-date information possible, data received after completion of worldwide commodity production tables have been included in many of the individual country production tables. Limitations of time, however, have prevented the incorporation of these revisions in the abbreviated versions of the world commodity tables included here. Thus, a more precise figure for total world production of any commodity could be obtained by adding figures presented in the individual country chapters. For summary purposes, however, it is felt that tables 18-41 of this chapter are sufficiently correct without the inclusion of these generally minor revisions.

The series of data on world trade in major mineral commodities that has appeared in most previous editions of this chapter (tables 57-69 in the 1976 edition) could not be included for a third time owing to scheduling problems. It is hoped that these tables will be resumed in the 1981 edition.

[1]Supervisory physical scientist, Geographic Statistics Staff, Branch of Foreign Data.
[2]Foreign mineral specialist, Geographic Statistics Staff, Branch of Foreign Data.
[3]For commodities included, see table 3 of this chapter.

Table 2.—Geographic distribution of world crude mineral production value, by country

Country	Value of production[1] (million 1978 U.S. dollars)			Country's share of total[2] (percent)			Country's rank among world producers[3]		
	1950	1973	1978	1950	1973	1978	1950	1973	1978
U.S.S.R	7,746.4	41,231.4	95,274.1	11.43	17.62	19.89	2	2	1
United States (including Puerto Rico)[4]	26,639.9	43,859.5	73,838.3	39.31	18.74	15.42	1	1	2
Saudi Arabia[5]	911.2	13,292.9	39,261.1	1.34	5.68	8.20	13	3	3
China, mainland	760.4	11,854.7	31,812.6	1.12	5.07	6.64	16	4	4
Iran	1,072.7	10,586.2	25,019.4	1.58	4.52	5.22	10	5	5
Canada	1,838.2	10,421.5	14,722.3	2.71	4.45	3.07	6	6	6
United Kingdom	3,942.6	4,125.8	12,350.4	5.82	1.76	2.58	3	13	7
Iraq	218.6	3,442.9	12,027.8	.32	1.47	2.51	32	17	8
Libya	--	6,274.7	10,693.0	--	2.68	2.23	--	9	9
Venezuela	3,409.7	7,373.9	10,377.1	5.03	3.15	2.17	4	7	10
Germany, Federal Republic of	3,395.9	7,162.1	10,015.8	5.01	3.06	2.09	5	8	11
Nigeria	49.8	5,341.9	9,930.6	.07	2.28	2.07	53	11	12
Kuwait[5]	488.3	5,252.1	9,779.0	.72	2.24	2.04	19	12	13
United Arab Emirates	--	2,900.9	9,085.3	--	1.24	1.90	--	19	14
Indonesia	478.9	3,620.8	9,034.9	.71	1.55	1.89	20	16	15
Poland	1,467.0	3,865.4	8,238.5	2.16	1.65	1.72	8	15	16
South Africa, Republic of	1,407.0	6,025.7	8,107.7	2.08	2.57	1.69	9	10	17
Mexico	922.3	2,138.1	7,371.2	1.36	.91	1.54	12	21	18
Australia	730.6	4,033.2	7,341.8	1.08	1.72	1.53	17	14	19
Algeria	55.9	3,314.5	6,810.4	.08	1.42	1.42	51	18	20
Netherlands	280.3	2,201.7	6,426.9	.41	.94	1.34	27	20	21
Romania	212.7	1,377.6	2,973.4	.31	.59	.62	33	27	22
France	1,699.6	2,025.4	2,832.8	2.51	.87	.59	7	22	23
Norway	42.4	272.2	2,765.5	.06	.12	.58	55	65	24
German Democratic Republic	425.8	1,753.1	2,652.9	.63	.75	.55	22	24	25
Argentina	169.0	1,043.6	2,419.5	.25	.45	.51	36	34	26
Qatar	56.1	1,080.0	2,389.6	.08	.46	.50	50	32	27
Egypt	110.0	352.5	2,374.6	.16	.15	.50	45	57	28
India	866.1	1,487.7	2,330.5	1.28	.64	.49	13	26	29
Brazil	114.1	1,360.7	2,310.3	.17	.58	.48	44	28	30
Malaysia	290.6	648.9	1,865.3	.43	.28	.39	26	39	31
Chile	649.5	1,913.1	1,835.9	.96	.82	.38	18	23	32
Peru	238.3	1,157.4	1,801.0	.35	.49	.38	30	30	33
Korea, North	27.6	1,014.5	1,757.8	.04	.43	.37	63	35	34
Czechoslovakia	435.3	1,082.2	1,723.1	.64	.46	.36	21	31	35
Oman	--	583.4	1,509.9	--	.25	.32	--	41	36
Trinidad and Tobago	129.9	431.7	1,325.7	.19	.18	.28	40	50	37

See footnotes at end of table.

Table 2.—Geographic distribution of world crude mineral production value, by country —Continued

Country	Value of production[1] (million 1978 U.S. dollars)			Country's share of total[2] (percent)			Country's rank among world producers[3]		
	1950	1973	1978	1950	1973	1978	1950	1973	1978
Brunei	182.3	435.8	1,310.2	.27	.19	.27	35	49	38
Japan	873.1	1,051.2	1,236.3	1.29	.45	.26	14	33	39
Yugoslavia	200.3	878.0	1,175.9	.30	.38	.25	34	37	40
Spain	360.0	708.9	1,160.7	.53	.30	.24	24	38	41
Gabon	4.8	386.1	1,160.4	.01	.16	.24	87	55	42
Zaire	371.7	1,272.6	949.4	.55	.54	.20	23	29	43
Ecuador	24.8	449.9	938.1	.04	.19	.20	66	48	44
Angola	15.7	550.6	936.8	.02	.24	.20	73	43	45
Colombia	266.6	524.8	902.7	.39	.22	.19	29	44	46
Italy	155.0	472.1	894.3	.23	.20	.19	38	47	47
Hungary	91.2	394.7	834.6	.13	.17	.17	47	54	48
Syria	--	218.3	833.5	--	.09	.17	--	66	49
Zambia	330.2	1,522.0	782.9	.49	.65	.16	25	25	50
Turkey	140.8	473.0	781.5	.21	.20	.16	39	46	51
Morocco	162.4	397.2	707.0	.24	.17	.15	37	53	52
Bolivia	236.5	429.8	688.9	.35	.18	.14	31	51	53
Korea, Republic of	21.1	347.5	672.1	.03	.15	.14	67	58	54
Namibia	98.8	406.3	636.7	.15	.17	.13	46	52	55
Tunisia	43.0	275.8	580.3	.06	.12	.12	54	63	56
Austria	120.2	335.4	571.4	.18	.14	.12	42	60	57
Philippines	65.5	595.6	516.7	.10	.25	.11	49	40	58
Sweden	275.7	574.6	441.6	.41	.25	.09	28	42	59
Thailand	55.1	180.1	428.8	.08	.08	.09	52	70	60
Other[6]	2,388.8	5,244.6	7,391.1	5.62	2.27	1.55	XX	XX	XX
Total	67,766.3	234,028.8	478,917.9	100.00	100.00	100.00	XX	XX	XX

XX Not applicable.

[1]Values are as reported in source except that the value assigned therein to Puerto Rico has been added to that for the United States, and the values assigned therein for Abu Dhabi, Dubai, and Sharjah have been combined under the heading United Arab Emirates.

[2]Percentages are as reported in source except for the inclusion of that for Puerto Rico with that for the United States and for the summation of the percentages for Abu Dhabi, Dubai, and Sharjah under the heading United Arab Emirates. Some percentages differ slightly from percentages calculated from corresponding value data in this table because of rounding value data.

[3]Rankings are as reported in source except for the adjustments necessary to correspond with the grouping of Abu Dhabi, Dubai, and Sharjah under the heading United Arab Emirates.

[4]Includes Puerto Rico.

[5]Includes allowance for production in the Kuwait-Saudi Arabia Partitioned Zone.

[6]Values and percentages derived by difference between the sum of figures for individually listed countries above and totals reported in source; for this reason percentages given may not be calculable from listed values.

Source: Annales des Mines, November-December 1980, pp. 32, 33.

Table 3.—Commodity distribution of world crude mineral production value

	Value of production (million 1978 U.S. dollars)			Commodity's share of total[1] (percent)			Commodity's rank among listed commodities		
	1950	1973	1978	1950	1973	1978	1950	1973	1978
Petroleum	22,908.0	111,018.0	266,140.0	33.80	47.44	55.57	2	1	1
Coal, anthracite and bituminous	25,625.8	42,559.4	77,602.2	37.82	18.19	16.20	1	2	2
Gas, natural	1,230.6	16,695.1	54,544.0	1.82	7.13	11.39	6	3	3
Iron ore	3,127.2	10,357.9	11,560.7	4.61	4.43	2.41	3	5	4
Natural gas liquids	1,093.5	4,518.8	9,135.5	1.61	1.93	1.91	7	8	5
Copper	2,584.1	14,738.4	8,607.6	3.81	6.30	1.80	4	4	6
Gold	2,572.1	6,138.7	7,524.1	3.80	2.62	1.57	5	6	7
Coal, lignite	936.1	4,588.1	6,826.7	1.38	1.96	1.43	10	7	8
Phosphates	337.7	1,275.4	3,019.4	.50	.55	.63	16	16	9
Uranium	--	761.9	2,655.4	--	.33	.55	--	21	10
Salt	476.9	1,688.8	2,646.7	.70	.72	.55	13	12	11
Tin	843.3	1,328.8	2,503.1	1.24	.57	.52	11	15	12
Potash	408.6	1,640.6	2,485.8	.60	.70	.52	14	13	13
Diamonds	232.7	1,585.4	2,000.4	.34	.68	.42	19	14	14
Lead	1,042.4	1,714.6	1,993.2	1.54	.73	.42	8	11	15
Zinc	990.0	2,257.8	1,910.6	1.46	.96	.40	9	9	16
Asbestos	258.8	850.9	1,909.1	.38	.36	.40	18	18	17
Silver	342.7	1,140.9	1,842.0	.51	.49	.38	15	17	18
Bauxite	136.8	819.3	1,597.5	.20	.35	.33	24	20	19
Nickel	232.0	1,892.0	1,526.5	.34	.81	.32	20	10	20
Sulfur	280.7	697.6	1,286.1	.41	.30	.27	17	22	21
Platinum	85.5	847.2	1,165.3	.13	.36	.24	28	19	22

See footnotes at end of table.

Table 3.—Commodity distribution of world crude mineral production value —Continued

	Value of production (million 1978 U.S. dollars)			Commodity's share of total[1] (percent)			Commodity's rank among listed commodities		
	1950	1973	1978	1950	1973	1978	1950	1973	1978
Molybdenum	76.4	439.7	1,007.0	.11	.19	.21	31	25	23
Manganese	516.5	622.0	896.9	.76	.27	.19	12	23	24
Kaolin	151.4	554.0	811.2	.22	.24	.17	22	24	25
Tungsten	118.1	295.1	784.6	.17	.13	.16	25	28	26
Chromite	137.1	219.9	621.0	.20	.09	.13	23	30	27
Borates	43.0	212.3	449.0	.06	.09	.09	36	31	28
Talc	61.5	227.0	400.2	.09	.09	.08	32	29	29
Magnesite	44.3	142.2	393.5	.07	.06	.08	34	34	30
Sodium carbonate	25.0	152.5	379.9	.04	.06	.08	41	33	31
Pyrite	110.8	324.6	369.9	.16	.14	.08	26	27	32
Fluorspar	84.7	345.6	342.5	.13	.15	.07	29	26	33
Vanadium	4.2	189.8	342.0	.01	.08	.07	48	32	34
Cobalt	34.7	103.9	280.7	.05	.04	.06	37	39	35
Bentonite	60.5	127.0	254.2	.09	.05	.05	33	35	36
Barite	43.8	123.8	226.1	.07	.05	.05	35	36	37
Ilmenite	30.2	115.2	118.9	.05	.05	.03	38	38	38
Antimony	80.8	115.4	107.4	.12	.05	.02	30	37	39
Mica	99.0	79.9	100.2	.15	.03	.02	27	42	40
Feldspar	12.8	69.0	82.1	.02	.03	.02	44	43	41
Columbium-tantalum	NA	60.0	78.7	NA	.03	.02	NA	44	42
Sodium sulfate	20.3	43.6	76.3	.03	.02	.02	43	46	43
Rutile	6.3	83.7	72.4	.01	.03	.01	46	41	44
Graphite	20.6	34.4	62.7	.03	.02	.01	42	48	45
Zircon	3.6	40.5	50.1	.01	.02	.01	49	47	46
Nitrates, nonferrous only	168.1	58.1	43.1	.25	.02	.01	21	45	47
Asphalt	26.1	20.7	35.1	.04	.01	.01	40	49	48
Mercury	28.7	95.7	24.8	.04	.04	.01	39	40	49
Kyanite	NA	17.6	23.3	NA	.01	.01	NA	50	50
Cryolite	7.3	NA	2.2	.01	NA	(2)	45	NA	51
Beryl	5.0	NA	NA	.01	NA	NA	47	NA	NA
Total	67,766.3	234,028.8	478,917.9	100.00	100.00	100.00	XX	XX	XX

NA Not available. XX Not applicable.

[1]Percentages as reported in source except that all have been rounded to the nearest one-hundredth of 1%; some differ slightly from percentages calculated from corresponding value data in this table because of rounding of value data.

[2]Less than 1/2 unit.

Source: Annales des Mines, November-December 1980, p. 18.

Table 4.—Value of world export trade in major mineral commodities[1]

(Million U.S. dollars)

Commodity group	1975[r]	1976[r]	1977[r]	1978[r]	1979
Metals:					
All ores, concentrates, scrap	14,367	15,692	15,803	16,484	23,400
Iron and steel	45,757	44,700	46,688	57,155	70,706
Nonferrous metals	18,691	21,546	24,126	27,554	36,920
Subtotal	78,815	81,938	86,617	101,193	131,026
Nonmetals, crude only	6,228	6,279	6,994	7,723	9,631
Mineral fuels	169,533	199,625	220,933	223,203	332,684
Total	254,576	287,842	314,544	332,119	473,341
All commodities	872,959	989,162	1,123,445	1,298,585	1,638,392

[r]Revised.

[1]Data presented are for selected major commodity groups of the Standard International Trade Classification Revised (SITC-R) and as such exclude some mineral commodities classified in that data array together with other (nonmineral) commodities. SITC-R categories included are as follows: All ores, concentrates, and scrap—SITC Div. 28; iron and steel—SITC Div. 67; nonferrous metals—SITC Div. 68; nonmetals (crude only)—SITC Div. 27; and mineral fuels—SITC Div. 3. Major items not included are the metals, metalloids, and metal oxides of SITC Group 513; mineral tar and other coal-, petroleum-, and gas-derived crude chemicals of SITC Div. 52; manufactured fertilizers of SITC Div. 56; and nonmetallic mineral manufactures of SITC Groups 661, 662, 663, and 667. Data include special category exports, ships' stores and bunkers, and other exports of minor importance, and exclude the intertrade of the centrally planned economy countries of Asia and trade between the Federal Republic of Germany and the German Democratic Republic.

Source: United Nations. Monthly Bulletin of Statistics. V. 35, No. 5, May 1981, pp. xxxiv-lvi.

Table 5.—Distribution of value of world export trade in major mineral commodity groups, by commodity group[1]

(Percent)

Commodity group	1975	1976	1977	1978	1979
Metals:					
All ores, concentrates, scrap	r5.7	r5.5	5.0	5.0	5.0
Iron and steel	18.0	15.5	r14.8	r17.2	14.9
Nonferrous metals	r7.3	7.5	7.7	r8.3	7.8
Total	r31.0	r28.5	r27.5	r30.5	27.7
Nonmetals, crude only	2.4	2.2	2.2	r2.3	2.0
Mineral fuels	r66.6	r69.3	73.3	67.2	70.3

rRevised.
[1]For detailed definition of groups, see footnote 1, table 4.

Table 6.—Growth of value of world export trade in major mineral commodity groups[1]

(Percent change from that of previous year)

Commodity group	1975	1976	1977	1978	1979
Metals:					
All ores, concentrates, scrap	-4.1	+9.2	+0.7	+4.3	+42.0
Iron and steel	-1.5	-2.3	+4.4	+22.4	+23.7
Nonferrous metals	-24.7	+15.3	+12.0	+14.2	+34.0
All metals	-8.6	+4.0	+5.7	+16.8	+29.5
Nonmetals, crude only	+7.7	+.8	+11.4	+10.4	+24.7
Mineral fuels	-2.0	+17.7	+10.7	+1.0	+49.0
All major mineral commodity groups	-3.9	+13.1	+9.3	+5.6	+42.5
All commodities	+4.1	+13.3	+13.6	+15.6	+26.2

[1]For detailed definition of groups, see footnote 1, table 4.

Table 7.—Annual investment expenditure in the steel industry for selected countries

(Million dollars unless otherwise specified)

Country or country group	1976	1977	1978	1979
EEC[1]	3,293	2,360	r2,022	2,000
EFTA[2]	816	476	r364	565
Other countries:				
Australia	164	140	132	122
Canada	392	416	r309	353
Japan	3,443	3,824	4,338	2,807
Spain	420	476	309	294
Turkey	271	304	387	NA
United States	3,255	2,850	r2,595	3,367
Total	[3]12,054	[3]10,846	10,456	9,508

rRevised. NA Not available.
[1]Source reports that values for European Economic Community (EEC) countries are in terms of "million units of account." For the Federal Republic of Germany (included in EEC in this tabulation), the source indicates that for 1976, 823.1 million "units of account" was equivalent to $885.3 million (no conversion rate given for other countries for 1976 and no conversion rate given for any country for 1977-79, and no further explanation is offered).
[2]European Free Trade Association (EFTA) figures exclude data for Switzerland.
[3]Figures have been totaled as if EEC data were in U.S. dollars, in keeping within totals appearing in a graph in source publication (see footnote 1).

Sources: Organization for Economic Cooperation and Development. The Iron and Steel Industry in 1977. Paris, 1979, p. 25; The Iron and Steel Industry in 1978. Paris, 1980, p. 25; and The Iron and Steel Industry for 1979. Paris, 1981, p. 22.

Table 8.—Market economy country petroleum industry capital and exploration expenditures, by geographical area

(Million dollars)

Area and type of expenditure	1976	1977	1978	1979
United States:				
Capital	22,085	22,400	24,475	32,200
Exploration	1,375	1,645	1,975	2,600
Total	23,460	24,045	26,450	34,800
Other Western Hemisphere:				
Capital	6,615	8,705	11,400	13,625
Exploration	385	650	760	1,200
Total	7,000	9,355	12,160	14,825
Western Europe:				
Capital	8,950	10,875	12,475	14,075
Exploration	325	450	475	550
Total	9,275	11,325	12,950	14,625
Africa:				
Capital	2,425	3,550	4,650	4,800
Exploration	175	300	375	350
Total	2,600	3,850	5,025	5,150
Near East:				
Capital	4,675	7,800	7,650	8,425
Exploration	75	125	150	175
Total	4,750	7,925	7,800	8,600
Far East:				
Capital	3,575	5,050	5,375	6,600
Exploration	200	225	300	450
Total	3,775	5,275	5,675	7,050
Foreign flag tankers	8,400	3,200	2,350	1,900
World:				
Capital (including foreign flag tankers)	56,725	61,580	68,375	81,625
Exploration	2,535	3,395	4,035	5,325
Grand total	59,260	64,975	72,410	86,950

Source: Chase Manhattan Bank, Energy Economics Div. 1979 Capital Investments of the World Petroleum Industry. New York, December 1980, Schedule 4.

Table 9.—Market economy country petroleum industry capital expenditures, by industry sector

(Million dollars)

Sector	1976	1977	1978	1979
Production:	23,860	28,680	33,675	44,500
Crude oil and natural gas	1,915	3,780	4,030	4,565
Natural gasoline plants	7,575	6,660	5,780	5,775
Pipelines	8,675	3,700	2,950	2,250
Marine	6,910	8,290	10,675	11,775
Refineries	2,180	2,670	3,240	3,750
Marketing	4,500	6,375	6,650	7,235
Chemical plants	1,110	1,425	1,375	1,775
Other	56,725	61,580	68,375	81,625
Total				

Source: Chase Manhattan Bank, Energy Economics Div. 1979 Capital Investments of the World Petroleum Industry. New York, December 1980, Schedule 4.

Table 10.—U.S. direct foreign investment in mineral industries: Value, earnings, and income

(Million dollars)

Area and country	Mining, smelting, refining			Petroleum		
	Value	Income[1]	Interest, dividends, earnings[2]	Value	Income[1]	Interest, dividends, earnings[2]
1977	r5,998	r504	r585	r28,030	r5,331	r6,117
1978	r5,733	r529	r598	r30,532	r6,010	r7,515
1979:						
Canada[r]	2,854	429	544	8,648	1,890	2,942
Latin America and other Western Hemisphere:						
Latin American Republics:						
Chile	r5	(3)	W	r70	r10	r19
Peru	W	W	W	W	W	W
Venezuela	W	W	W	r57	r17	r32
Other[r 4]	1,186	330	355	3,821	1,365	2,129
Subtotal[r]	1,191	330	355	3,948	1,392	2,180
Other Western Hemisphere	212	r109	r118	r1,292	r879	1,498
Total[r 5]	1,403	439	473	5,240	2,271	3,678
Europe:						
EEC:						
Denmark and Ireland	(3)	(3)	(3)	r575	W	W
United Kingdom	W	(3)	(3)	r6,764	r1,701	r2,691
Other[4]	r14	(3)	(3)	r7,580	r2,378	r4,152
Subtotal	r14	(3)	(3)	r14,919	r4,079	r6,843
Other Western Europe[r]	20	1	2	2,837	404	524
Total[r 5]	34	1	2	17,756	4,483	7,367
Africa:						
South Africa, Republic of	r137	r26	W	W	W	W
Other	r443	W	W	r1,730	r1,122	r1,188
Total[6]	580	r26	W	r1,730	r1,122	r1,188
Near East	W	W	W	W	r2,445	r2,666
Far East and Pacific:						
Japan	(3)	(3)	(3)	r1,906	r253	r376
Australia[r]	1,166	312	390	1,158	243	302
New Zealand	r4	r1	W	W	W	W
Other	W	W	W	r2,481	r1,373	r1,485
Total[r]	1,170	313	390	5,545	1,869	2,163
International and unallocated shipping	(3)	(3)	(3)	r2,432	r119	r140
Grand total[r 5]	5,941	1,148	1,380	38,744	13,413	18,827
1980:						
Canada	2,997	604	839	10,573	2,003	3,392
Latin America and other Western Hemisphere:						
Latin American Republics:						
Chile	7	4	W	70	6	3
Peru	W	W	W	W	W	W
Venezuela	W	(3)	(3)	39	(3)	13
Other[4]	1,401	289	353	4,227	957	1,235
Subtotal	1,408	293	353	4,336	963	1,251
Other Western Hemisphere	312	95	97	1,304	531	654
Total[5]	1,720	388	450	5,640	1,494	1,905
Europe:						
EEC:						
Denmark and Ireland	(3)	(3)	(3)	696	26	W
United Kingdom	W	W	W	6,292	2,256	2,819
Other[4 6]	W	10	13	9,916	2,830	7,181
Subtotal	W	10	13	16,904	5,112	10,000
Other Western Europe	W	2	4	3,020	743	925
Total[5]	W	12	17	19,924	5,855	10,925

See footnotes at end of table.

Table 10.—U.S. direct foreign investment in mineral industries: Value, earnings, and income —Continued

(Million dollars)

Area and country	Mining, smelting, refining			Petroleum		
	Value	Income[1]	Interest, dividends, earnings[2]	Value	Income[1]	Interest, dividends, earnings[2]
Africa:						
South Africa, Republic of	158	41	68	W	W	W
Other	465	W	W	2,210	1,244	1,304
Total[7]	623	41	68	2,210	1,244	1,304
Near East	W	(3)	(3)	W	(3)	(3)
Far East and Pacific:						
Japan	(3)	(3)	(3)	1,566	175	205
Australia	1,292	362	485	1,224	302	372
New Zealand	3	2	2	W	W	W
Other	W	W	W	2,771	2,243	2,449
Total	1,295	364	487	5,661	2,720	3,026
International and unallocated shipping	(3)	(3)	(3)	W	344	326
Grand total[5]	6,493	1,376	1,825	46,920	13,022	17,575

[r]Revised. W Withheld (in source publication) to avoid disclosing company proprietary data.
[1]Sum of U.S. share in net earnings of subsidiary and branch profits.
[2]Sum of interest, dividends, and earnings of unincorporated affiliates.
[3]Less than 1/2 unit.
[4]Calculated, by difference between listed detail and reported total.
[5]Detail may not add to totals shown because of independent rounding and exclusion of some data, including negative figures, in detail.
[6]Includes Belgium, France, the Federal Republic of Germany, Italy, Luxembourg, and the Netherlands.
[7]Not reported in source; sum of reported detail, and incomplete in some cases, owing to withheld data in detail.

Source: U.S. Department of Commerce. U.S. Direct Investment Abroad. Aug. 13, 1981.

Table 11.—World merchant fleet distribution, by type[1]

	1974	1975	1976	1977	1978	1979
Number of vessels:						
Tankers	5,121	5,311	5,383	5,333	5,233	5,260
Bulk carriers	4,075	4,272	4,570	4,932	4,651	4,714
Freighters	[2]11,449	12,575	12,923	[r]13,176	14,141	14,329
Other	[3]1,804	714	710	655	487	495
Total	22,449	22,872	23,586	24,096	24,512	24,798
Gross tonnage:						
Tankers thousand metric tons	143,399	163,731	179,116	185,405	182,367	183,130
Bulk carriers do	82,313	88,194	95,451	103,741	104,291	105,341
Freighters do	[2]68,855	75,284	77,939	81,414	87,700	89,643
Other do	[3]11,799	5,833	5,697	5,268	4,551	4,535
Total do	306,366	333,042	358,203	375,828	378,909	382,649
Deadweight tonnage:						
Tankers do	261,440	302,217	335,600	349,976	344,780	345,880
Bulk carriers do	139,267	150,080	163,298	178,633	180,436	182,319
Freighters do	[2]93,476	101,248	104,639	109,857	117,953	120,494
Other do	[3]9,165	3,027	2,962	2,753	2,319	2,209
Total do	503,348	556,572	606,499	641,219	645,488	650,902

[1]Maritime Administration classification. Tankers include whaling tankers. Vessels shown here as "Other" include combination passenger and cargo and combination passenger and refrigerated cargo. The contribution of these vessels to mineral commodity trade is regarded as unimportant. Data are as of December 31 of year indicated.
[2]Excludes refrigerated freighters.
[3]Includes refrigerated freighters.

Source: U.S. Department of Commerce, Maritime Administration. Merchant Fleets of the World. Annual issues covering 1973 through 1977, and unpublished data supplied for 1978.

Table 12.—World shipping loadings and unloadings

(Million metric tons)

	1974	1975	1976	1977[r]	1978[r]	1979
Loadings:						
Tanker cargo	1,837	1,644	[r]1,823	1,896	1,899	2,003
Dry cargo	1,476	1,428	[r]1,523	1,579	1,651	1,775
Total	3,313	3,072	[r]3,346	3,475	3,550	3,778
Unloadings:						
Tanker cargo	1,784	1,660	1,814	1,904	1,954	2,039
Dry cargo	1,477	1,396	[r]1,518	1,536	1,569	1,742
Total	3,261	3,056	[r]3,332	3,440	3,523	3,781

[r]Revised.

Source: United Nations. Monthly Bulletin of Statistics. V. 35, No. 3, March 1981, p. xxix.

Table 13.—World shipping of dry cargo, by geographical area

(Million metric tons)

Area	Loadings			Unloadings		
	1977	1978	1979	1977	1978	1979
Market economy countries:						
Developed:						
Australia and New Zealand	172	[r]178	186	20	21	24
Canada	116	[r]112	130	41	[r]44	49
Japan	79	81	83	[r]318	[r]296	334
South Africa, Republic of	30	[r]52	60	[r]8	[r]7	8
United States	249	265	310	137	[r]122	115
Western Europe	[r]331	[r]369	372	[r]564	[r]578	654
Other	[r]3	4	5	[r]10	[r]6	7
Total	[r]980	[r]1,061	1,146	[r]1,098	[r]1,074	1,191
Developing:						
Caribbean	[r]29	[r]28	42	17	[r]17	19
Venezuela	25	[r]13	15	7	[r]13	13
Other Latin America	[r]153	[r]159	166	[r]55	[r]59	60
Far East	[r]156	[r]163	180	[r]129	[r]149	179
Near East	[r]16	[r]30	26	[r]57	[r]65	66
Northern Africa	29	[r]36	32	[r]41	39	46
Other Africa	[r]70	[r]56	59	[r]29	[r]33	36
Other	[r]12	[r]8	8	(1)	[r]3	3
Total	[r]490	[r]493	528	[r]335	[r]378	422
Centrally planned economy countries:						
U.S.S.R.	[r]50	[r]36	38	26	[r]36	44
Other	[r]59	[r]61	63	[r]77	[r]81	85
Total	[r]109	[r]97	101	[r]103	[r]117	129

[r]Revised.
[1]Revised to zero.

Source: United Nations. Monthly Bulletin of Statistics. V. 35, No. 3, March 1981, pp. xxix-xxxiii.

Table 14.—World shipping of tanker cargo, by geographical area

(Million metric tons)

Area	Loadings			Unloadings		
	1977	1978	1979	1977	1978	1979
Market economy countries:						
Developed:						
Australia and New Zealand	3	r2	3	16	r16	17
Canada	4	r5	5	18	r18	18
Japan	--	--	--	r264	r262	274
South Africa, Republic of	--	--	--	r17	r18	14
United States	r1	9	16	431	r424	432
Western Europe	r125	r120	178	r743	728	784
Other	r7	r2	1	r8	r8	8
Total	r140	r138	203	r1,497	r1,474	1,547
Developing:						
Caribbean	48	r48	47	93	94	95
Venezuela	103	r101	107	--	--	--
Other Latin America	r22	r30	44	67	r67	76
Far East	r112	r116	110	r125	r144	144
Near East	r1,041	r982	981	r28	r25	30
Northern Africa	r153	r232	244	11	r88	87
Other Africa	r149	r114	133	r35	r17	16
Other	--	1	--	r6	r4	3
Total	r1,628	r1,624	1,666	r365	r439	451
Centrally planned economy countries:						
U.S.S.R.	r104	r115	112	7	r7	8
Other	r24	r22	22	35	r34	33
Total	r128	r137	134	42	r41	41

rRevised.

Source: United Nations. Monthly Bulletin of Statistics. V. 35, No. 3, March 1981, pp. xxix-xxxiii.

Table 15.—Nonferrous metal prices in the United States

(Average cents per pound unless otherwise specified)

Year and month	Aluminum[1]	Copper[2]	Lead[3]	Zinc[4]	Tin[5]	Silver[6]
1977	51.339	65.804	30.703	34.386	499.381	462.302
1978	53.075	65.510	33.653	30.971	586.674	540.089
1979:						
January	55.000	75.574	40.760	34.574	643.273	625.455
February	55.000	88.697	43.632	35.617	685.222	741.716
March	55.341	95.718	45.749	37.241	713.864	744.518
April	58.000	97.322	48.000	38.993	691.619	749.250
May	58.000	90.234	48.805	39.387	695.000	837.346
June	58.000	87.241	56.510	39.387	707.857	853.833
July	58.000	85.768	58.066	39.387	708.333	913.505
August	58.000	90.335	57.913	36.902	687.391	933.387
September	60.079	94.853	58.004	35.797	721.632	1,395.916
October	65.318	98.106	61.057	36.206	749.773	1,678.073
November	66.000	98.708	57.262	36.823	766.316	1,660.265
December	66.000	105.448	55.947	37.233	788.750	2,179.278
Average	59.395	92.334	52.642	37.296	713.253	1,109.379
1980:						
January	66.000	118.385	49.879	37.442	780.636	3,825.68
February	66.000	132.308	49.559	37.495	805.579	3,508.50
March	66.000	105.040	49.233	37.956	820.905	2,413.33
April	68.000	93.851	44.015	38.012	794.318	1,450.00
May	68.000	92.479	36.002	37.497	785.238	1,253.28
June	68.000	91.713	34.190	36.435	776.667	1,574.76
July	68.000	102.565	35.604	35.500	773.545	1,605.93
August	68.000	99.708	40.962	35.729	775.810	1,589.71
September	69.333	97.864	42.259	36.633	803.048	2,014.38
October	75.455	98.471	45.000	37.265	770.455	2,018.13
November	76.000	95.982	43.806	38.582	721.176	1,864.82
December	76.000	88.127	38.966	40.590	673.864	1,639.33
Average	69.566	101.374	42.456	37.428	773.437	2,063.15

[1]Unalloyed ingot, 99.5%, delivered United States.
[2]Electrolytic copper, domestic refineries, on Atlantic seaboard.
[3]Refined lead, nationwide.
[4]Prime Western slab, f.o.b. East St. Louis.
[5]Straits tin, New York.
[6]Cents per troy ounce, 999 fine, New York.

Table 16.—Nonferrous metal prices in the United Kingdom[1]

(Average U.S. cents per pound unless otherwise specified)

Year and month	Aluminum[2]	Copper[3]	Lead[4]	Zinc	Tin[5]	Silver[6]
1977	51.890	59.380	28.002	26.733	489.539	463.310
1978	60.060	61.826	29.803	26.870	583.912	541.883
1979:						
January	57.376	75.264	44.967	32.641	630.544	621.001
February	65.405	88.191	47.791	35.921	665.883	734.710
March	69.932	92.973	53.318	36.004	684.403	741.622
April	71.184	95.237	52.601	35.739	688.356	745.084
May	71.553	87.373	56.158	35.275	697.400	839.377
June	72.484	85.181	62.627	34.133	732.639	855.900
July	69.594	82.283	57.644	r32.687	716.438	915.618
August	70.804	89.650	54.962	30.124	671.588	930.830
September	73.266	95.067	55.771	32.794	698.845	1,377.149
October	80.897	94.145	59.768	31.998	727.861	1,666.249
November	83.347	94.805	55.492	31.764	743.221	1,666.121
December	86.843	100.427	53.334	33.977	771.154	2,237.919
Average	72.724	90.113	54.520	33.588	702.678	1,110.965
1980:						
January	93.213	117.959	50.663	35.034	771.689	3,924.93
February	96.600	132.363	52.926	39.388	775.663	3,556.56
March	89.674	104.601	50.718	33.637	792.671	2,463.94
April	87.423	93.970	43.884	32.042	773.717	1,495.56
May	80.541	92.868	35.493	31.309	782.724	1,265.89
June	75.667	91.003	33.442	30.710	782.121	1,579.36
July	79.778	98.720	36.736	32.323	776.310	1,632.14
August	80.946	94.442	38.652	34.833	771.974	1,592.04
September	75.051	93.460	40.007	36.065	785.112	1,988.37
October	73.774	92.794	39.502	36.486	757.139	2,021.75
November	68.088	91.196	36.893	36.329	708.307	1,859.23
December	65.000	85.213	33.684	35.501	667.132	1,643.94
Average	80.753	99.297	41.213	34.482	763.087	2,085.31

rRevised.
[1]London Metal Exchange average settlement prices.
[2]Ingot, 99.5%.
[3]Electrolytic wirebar.
[4]Refined pig lead, 99.97%.
[5]Standard tin.
[6]U.S. cents per troy ounce, 999 fine.

Table 17.—Nonferrous metal prices in Canada

(Average U.S. cents per pound unless otherwise specified)

Year and month	Copper[1 2]	Lead[3]	Zinc[3]	Silver[4]
1977	65.999	29.336	32.996	461.214
1978	66.376	32.213	29.966	540.555
1979:				
January	74.895	r39.193	33.082	625.930
February	86.729	r41.317	35.463	742.058
March	98.717	r44.685	37.018	744.941
April	100.691	r47.543	39.256	749.728
May	91.639	r47.987	38.940	837.633
June	88.971	52.640	38.383	854.219
July	86.387	r56.707	38.664	916.650
August	90.257	r56.381	36.306	936.292
September	93.616	r56.863	35.748	1,396.262
October	98.419	60.410	36.586	1,678.487
November	98.794	r55.101	36.452	1,662.101
December	105.498	54.769	36.753	2,159.334
Average	92.884	r51.133	36.888	1,108.636
1980:				
January	116.230	49.790	36.942	3,825.661
February	133.549	49.331	38.368	3,509.960
March	105.409	48.352	38.365	2,404.788
April	93.037	44.444	37.459	1,449.812
May	92.060	36.910	36.627	1,257.398
June	91.799	34.486	36.202	1,571.384
July	100.581	35.620	35.147	1,603.316
August	98.176	40.276	35.183	1,590.949
September	96.534	41.357	537.350	2,015.158
October	97.111	44.052	37.695	2,018.355
November	94.737	42.817	39.151	1,877.808
December	87.930	38.657	40.944	1,639.865
Average	100.596	42.174	37.453	2,063.705

rRevised.
[1]Electrolytic wirebar, f.o.b. delivered Canadian points.
[2]Canadian domestic producer delivered price for cathode in 1980.
[3]Pig lead, Prime Western zinc; producer's prices, carload quantities, communicated by Cominco, Ltd.
[4]U.S. cents per troy ounce, average price of Cominco, Ltd.
[5]Commencing with September, Cominco changed its base grade to High Grade instead of Prime Western and from then, Prime Western carried a 0.50 cent premium over High Grade.

Table 18.—Leading world producers of bauxite[1]

(Gross weight, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
Australia	24,084	26,086	24,293	27,583	2,27,584
Guinea[e]	r10,848	r10,841	10,456	13,700	2,13,780
Jamaica	r10,296	11,433	11,777	11,505	2,12,261
U.S.S.R.[e 3]	6,025	6,180	6,180	6,180	6,180
Suriname	r4,613	r4,805	5,188	5,010	4,696
Brazil	827	1,120	1,160	2,388	3,970
Yugoslavia	2,033	2,044	2,565	3,012	2,3,138
Hungary	2,918	2,949	2,899	2,976	3,020
Greece	2,551	r2,882	2,664	2,915	2,950
Guyana[e]	2,686	2,731	r2,425	r2,312	2,348
India	r1,449	r1,519	1,663	1,934	2,1,740
France	2,330	2,059	1,978	1,969	2,1,665
United States	1,989	2,013	1,669	1,821	2,1,559
China, mainland[e]	r1,300	r1,500	r1,500	r1,500	1,500
Total[2]	r73,949	r78,162	76,417	84,805	86,391
Other	r4,993	r5,486	r5,014	4,451	5,122
Grand total[2]	r78,942	r83,648	81,431	89,256	91,513

[e]Estimated. [p]Preliminary. rRevised.
[1]Table includes data available as of July 1, 1981.
[2]Reported figure.
[3]Includes bauxite equivalent of nepheline syenite concentrates and alunite ore (produced in the U.S.S.R. only).

Table 19.—Leading world producers of aluminum[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
United States	3,856	4,118	4,358	4,557	4,654
U.S.S.R.[e]	1,600	1,640	1,670	1,750	1,790
Japan	919	1,188	1,058	1,011	[2]1,091
Canada	633	[r]973	1,049	860	[2]1,068
Germany, Federal Republic of	697	742	740	742	[2]731
Norway	618	[r]622	639	660	[2]651
France	385	400	391	395	[2]432
Spain	[r]210	211	212	259	[2]386
United Kingdom	335	350	347	359	[2]375
China, mainland[e]	[r]318	[r]349	360	360	360
Venezuela	46	[r]44	76	207	313
Australia	232	248	263	269	[2]304
Italy	[r]207	260	270	269	[2]271
Netherlands	256	241	261	259	[2]259
Brazil	139	167	186	238	256
Romania	[r]203	209	213	217	241
India	210	[r]185	205	211	[2]185
Total	[r]10,864	[r]11,947	12,298	12,623	13,367
Other	[r]1,758	[r]1,839	1,820	1,940	2,001
Grand total	[r]12,622	[r]13,786	14,118	14,563	15,368

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 25, 1981.
[2]Reported figure.

Table 20.—Leading world producers of chromite[1]

(Gross weight, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
South Africa, Republic of	2,409	3,059	3,145	3,297	[2]3,414
U.S.S.R.[e]	2,120	2,180	2,300	2,400	2,450
Albania[e]	830	880	990	1,015	1,077
Philippines	431	[r]539	537	561	573
Zimbabwe	864	677	478	542	554
Turkey[e]	580	508	375	450	400
Brazil	186	310	270	340	350
India	402	352	266	309	[2]320
Finland	175	169	178	177	175
Total	7,997	[r]8,674	8,539	9,091	9,313
Other	[r]496	[r]546	499	444	417
Grand total	[r]8,493	[r]9,220	9,038	9,535	9,730

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 31, 1981.
[2]Reported figure.

Table 21.—Leading world producers of mine copper[1]

(Cu content of ore, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
United States[2]	1,457	1,364	1,358	1,444	[3]1,168
Chile[2]	1,005	1,056	1,036	1,061	1,068
U.S.S.R.[e 2]	800	830	865	885	900
Canada[2]	731	759	659	636	710
Zambia[2]	709	656	643	588	[3]596
Zaire[2]	444	482	424	400	[3]459
Peru[2]	220	341	366	400	[3]365
Poland	267	289	321	325	[2]346
Philippines	238	273	263	301	324
Australia	218	222	222	235	[3]217
South Africa, Republic of	197	208	209	191	215
China, mainland[e]	[r]180	[r]195	[r]200	[r]200	200
Papua New Guinea	176	182	199	[2]171	[3]147
Total	[r]6,642	[r]6,857	6,765	6,837	6,715
Other	[r]883	[r]899	868	838	902
Grand total	[r]7,525	[r]7,756	7,633	7,675	7,617

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 29, 1981.
[2]Recoverable.
[3]Reported figure.

Table 22.—Leading world producers of gold[1]

(Thousand troy ounces)

Country	1976	1977	1978	1979[p]	1980[e]
South Africa, Republic of	22,936	22,502	22,649	22,617	[2]21,669
U.S.S.R.[e]	7,700	7,850	8,000	8,160	8,300
Canada	1,692	1,734	1,735	1,644	[2]1,552
Brazil	240	280	301	354	1,300
United States	1,048	1,100	999	970	[2]951
Philippines	501	[r]559	587	561	701
Australia	503	630	648	597	[2]557
Papua New Guinea	668	740	751	630	[2]452
Ghana	532	481	402	362	410
Dominican Republic	413	343	343	353	[2]370
Zimbabwe	387	402	399	386	367
Total	[r]36,620	[r]36,621	36,814	36,634	36,629
Other	[r]2,404	[r]2,300	2,171	2,168	2,253
Grand total	[r]39,024	[r]38,921	38,985	38,802	38,882

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 8, 1981.
[2]Reported figure.

Table 23.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R	[r]241,108	[r]241,851	246,251	241,738	[2]245,000
Brazil	94,087	82,001	84,985	104,083	106,000
Australia	[r]93,255	95,923	83,134	91,717	[2]95,542
China, mainland[e]	[r]60,000	50,000	70,000	75,000	75,000
United States	81,277	56,646	82,892	87,092	[r]70,672
Canada	[r]55,555	[r]57,637	41,751	59,888	[r]48,754
India	43,868	42,598	38,837	39,534	40,670
France	45,181	36,630	33,454	31,627	[2]28,980
Sweden	29,862	24,839	21,486	26,619	[2]27,184
South Africa, Republic of	15,663	26,481	24,206	29,565	[2]26,312
Liberia	[r]20,532	[r]17,660	17,989	18,345	17,380
Venezuela	18,685	13,683	13,515	16,349	[2]16,102
Spain	8,227	8,327	8,580	8,827	8,990
Mauritania	[r]9,644	9,794	6,934	9,373	8,600
Chile	10,055	[r]7,891	7,042	7,526	[2]8,587
Mexico	5,785	5,694	5,645	6,414	8,075
Korea, North[e]	[r]6,600	[r]6,900	[r]7,100	[r]7,400	8,000
Total	[r]839,384	[r]784,555	793,802	861,097	839,848
Other	[r]59,920	[r]57,074	54,965	50,400	47,749
Grand total	[r]899,304	[r]841,629	848,767	911,497	887,597

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 10, 1981.
[2]Reported figure.

Table 24.—Leading world producers of crude steel[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R	144,825	146,678	151,436	149,099	[2]148,000
Japan	107,399	102,405	102,105	111,748	[2]111,408
United States	116,120	113,700	124,312	123,694	[2]101,455
Germany, Federal Republic of	42,415	38,985	41,253	46,040	[2]43,840
China, mainland	20,502	23,740	31,780	34,430	[2]36,100
Italy	23,447	23,334	24,283	24,250	[2]26,509
France	23,221	22,094	22,841	23,264	[2]23,165
Poland	15,639	17,841	19,251	19,218	[2]19,484
Canada	13,290	13,631	14,898	16,078	[2]15,901
Brazil	9,169	11,164	12,107	13,816	[2]15,324
Czechoslovakia	14,693	15,064	15,294	14,817	[2]14,225
Romania	10,733	11,457	11,779	12,909	[2]13,176
Belgium	12,145	11,256	12,601	13,442	[2]12,320
Spain	11,002	11,102	11,645	12,304	11,503
United Kingdom	22,274	20,411	20,311	21,476	[2]11,304
India	9,255	9,918	9,987	9,996	10,270
South Africa, Republic of	7,156	[r]7,376	7,902	8,875	8,981
Australia	7,774	7,313	7,589	8,125	[2]7,924
Total	[r]611,059	[r]607,469	641,374	663,581	630,889
Other	[r]62,471	[r]62,582	68,547	76,939	76,691
Grand total	[r]673,530	[r]670,051	709,921	740,520	707,580

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Steel ingots and castings. Table includes data available through May 31, 1981.
[2]Reported figure.

Table 25.—Leading world producers of mine lead[1]

(Pb content of ore, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
United States[2]	553	537	630	526	[3]550
U.S.S.R.[e]	500	510	520	525	525
Australia	397	432	400	422	[3]395
Canada	256	281	320	311	[3]274
Peru[2]	160	166	183	184	[3]189
China, mainland[e]	[r]130	[r]135	145	155	155
Mexico[2]	200	163	171	174	[3]146
Morocco	60	93	100	116	130
Yugoslavia	122	130	124	130	[3]119
Bulgaria[e]	110	117	117	116	116
Korea, North[e]	110	110	105	100	100
Total	[r]2,598	[r]2,674	2,815	2,759	2,699
Other	[r]747	[r]768	764	764	819
Grand total	[r]3,345	[r]3,442	3,579	3,523	3,518

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 15, 1981.
[2]Recoverable.
[3]Reported figure.

Table 26.—Leading world producers of manganese ore[1]

(Gross weight, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R.	8,636	[r]8,591	9,057	10,244	[2]10,251
South Africa, Republic of	5,452	5,048	4,317	5,182	[2]5,695
Brazil	1,696	1,516	1,917	2,259	2,180
Gabon	2,217	1,851	1,661	2,300	[2]2,147
Australia	2,154	1,389	1,249	1,666	[2]1,961
India	1,835	1,865	1,619	1,755	[2]1,645
China, mainland[e]	1,000	[r]1,100	[r]1,300	1,500	1,600
Mexico	453	487	523	493	[2]447
Ghana	312	292	316	271	[2]252
Morocco	117	114	126	135	150
Hungary	125	120	114	83	88
Total	[r]23,997	[r]22,373	22,199	25,888	26,416
Other	[r]600	[r]450	338	311	281
Grand total	[r]24,597	[r]22,823	22,537	26,199	26,697

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Tables includes data available through July 1, 1981.
[2]Reported figure.

Table 27.—Leading world producers of mine nickel[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
Canada	241	233	138	126	[2]195
U.S.S.R.[e]	[r]141	[r]144	148	152	154
New Caledonia	110	105	66	83	[2]88
Australia	83	86	82	70	[2]71
Philippines	[r]15	37	30	29	38
Cuba[e]	37	37	37	35	37
Indonesia	29	33	32	37	37
South Africa, Republic of	22	22	22	29	29
Total	[r]678	[r]697	555	561	649
Other	[r]114	[r]107	105	122	122
Grand total	[r]792	[r]804	660	683	771

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 13, 1981.
[2]Reported figure.

Table 28.—Leading world producers of mine tin[1]

(Sn content of ore, metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
Malaysia	63,401	58,703	62,650	62,995	[2]61,404
U.S.S.R.[e]	31,000	33,000	34,000	35,000	36,000
Thailand	20,452	24,205	30,186	33,962	[2]33,685
Indonesia	[r]23,435	25,926	27,411	29,535	[2]32,527
Bolivia	30,315	[r]33,740	30,881	27,648	[2]27,272
China, mainland[e]	[r]11,000	[r]13,000	[r]14,000	[r]14,000	14,600
Australia	10,611	10,634	11,864	12,571	[2]11,364
Brazil	5,388	6,450	6,976	7,716	8,000
Zaire	3,776	5,073	4,390	3,879	3,000
United Kingdom	3,323	3,851	2,802	2,374	2,960
South Africa, Republic of	2,799	2,864	2,886	2,697	2,800
Nigeria	3,710	3,267	2,935	2,750	2,500
Total	[r]209,210	[r]220,713	230,981	235,127	236,112
Other	[r]9,202	[r]9,507	10,374	10,191	10,135
Grand total	[r]218,412	[r]230,220	241,355	245,318	246,247

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through May 25, 1981.
[2]Reported figure.

Table 29.—Leading world producers of mine zinc[1]

(Zn content of ore, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
Canada	982	1,070	1,067	1,100	[2]895
U.S.S.R.[e]	720	735	770	770	785
Australia	[r]469	492	473	532	[2]494
Peru	421	405	458	491	[2]487
United States	440	408	303	267	[2]335
Japan	260	276	275	243	[2]238
Mexico	259	[r]266	245	246	[2]238
Ireland	63	116	176	212	[2]229
Poland[e]	180	188	194	183	180
Spain	84	98	147	143	168
Sweden	128	140	163	170	167
China, mainland[e]	[r]150	[r]150	[r]160	[r]160	160
Korea, North[e]	[r]160	150	[r]145	[r]145	140
Yugoslavia	107	112	104	102	100
Germany, Federal Republic of	111	111	97	97	[2]100
Greenland	81	77	82	87	92
Bulgaria	86	87	88	85	87
Total	[r]4,701	[r]4,881	4,947	5,033	4,895
Other	[r]1,024	[r]1,064	981	884	866
Grand total	[r]5,725	[r]5,945	5,928	5,917	5,761

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 1, 1981.
[2]Reported figure.

Table 30.—Leading world producers of hydraulic cement[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R.	124,246	[r]127,049	126,956	123,019	125,000
Japan	68,712	73,138	84,868	87,804	[2]88,128
China, mainland	[r]49,299	[r]55,649	65,239	73,900	[2]81,400
United States	67,580	72,627	77,546	77,931	[2]76,709
Italy	36,327	37,721	37,758	40,140	[2]42,825
Germany, Federal Republic of	[r]35,417	[r]33,408	35,342	37,036	[2]35,798
France	29,394	28,829	28,025	28,825	[2]29,104
Spain (including Canary Islands)	25,202	27,995	30,233	27,912	28,460
Brazil	[r]19,146	[r]19,162	22,100	24,880	26,490
Poland	19,800	21,300	21,700	19,176	[2]18,443
India	[r]18,696	[r]19,176	19,632	18,264	17,510
Mexico	12,584	13,227	14,056	15,178	16,000
Korea, Republic of	[r]11,872	14,196	15,133	16,413	[2]15,631
Romania	13,088	13,875	14,688	15,598	15,600
United Kingdom	15,780	15,456	15,916	16,140	[2]14,808
Turkey	12,342	13,833	15,129	13,788	14,200
German Democratic Republic	[r]11,343	12,102	12,521	12,273	[2]12,444
Total	[r]570,829	[r]598,743	636,842	648,277	658,550
Other	[r]186,025	[r]196,446	215,690	225,540	228,338
Grand total	[r]756,854	[r]795,189	852,532	873,817	886,888

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 24, 1981.
[2]Reported figure.

Table 31.—Leading world producers of diamond[1]

(Thousand carats)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R.[e]	9,900	10,300	10,550	10,700	10,850
Zaire	11,821	[r]11,214	11,243	8,734	[2]10,235
South Africa, Republic of	7,023	7,643	7,727	8,384	[2]8,522
Botswana	[r]2,361	2,691	2,785	4,394	[2]5,101
Namibia	1,694	2,001	1,898	1,653	[2]1,560
Ghana	2,283	1,947	1,423	1,253	1,200
Total	[r]35,082	[r]35,796	35,626	35,118	37,468
Other	[r]3,776	[r]3,542	3,665	3,895	4,170
Grand total	[r]38,858	[r]39,338	39,291	39,013	41,638

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Gem and industrial grades undifferentiated. Table includes data available through June 30, 1981.
[2]Reported figure.

Table 32.—Leading world producers of nitrogen in ammonia[1]

(N content, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
United States	12,570	13,347	12,911	13,546	[2]14,273
U.S.S.R.	[r]10,180	10,744	11,300	12,200	12,400
China, mainland[e]	[r]4,080	5,620	6,750	7,170	7,500
Romania	1,659	1,792	2,257	2,332	2,400
Japan	2,236	2,292	2,454	2,415	2,330
Netherlands	1,980	2,140	2,148	2,253	[2]2,144
India[3]	1,910	2,037	2,200	2,256	2,100
France	1,781	2,034	2,016	2,150	2,085
Germany, Federal Republic of	1,863	1,989	1,955	2,161	[2]2,044
Canada	1,258	1,764	1,926	1,981	1,996
United Kingdom	1,348	1,631	1,600	1,630	[2]1,633
Poland	1,726	1,665	1,611	1,525	[2]1,481
Mexico	716	780	1,299	1,360	1,420
Italy	1,219	1,168	1,444	1,431	1,400
German Democratic Republic	1,119	[r]1,129	1,137	1,078	1,100
Total	[r]45,645	[r]50,132	53,008	55,488	56,306
Other	[r]11,233	[r]12,026	12,873	14,282	14,532
Grand total	[r]56,878	[r]62,158	65,881	69,770	70,838

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Erroneously captioned in 1978-79 edition of this chapter. Table includes data available through June 5, 1981.
[2]Reported figure.
[3]Data given are for years beginning April 1 of that stated.

Table 33.—Leading world producers of phosphate rock[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
United States	44,671	47,256	50,037	51,611	[2]54,415
U.S.S.R.[e 3]	23,900	24,250	24,962	25,580	26,000
Morocco[4]	15,829	17,804	19,713	20,032	[2]18,824
China, mainland[e]	4,000	4,000	4,500	[r]5,500	5,500
Tunisia	3,301	3,615	3,712	4,154	[2]4,582
Jordan	1,717	1,782	2,303	2,825	[2]4,243
South Africa, Republic of	1,731	2,403	2,699	3,221	[2]3,185
Togo	2,008	2,857	2,827	2,920	[2]2,933
Total	97,157	[r]103,967	110,753	115,843	119,682
Other	[r]10,463	[r]12,691	15,159	14,357	15,235
Grand total	[r]107,620	[r]116,658	125,912	130,200	134,917

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Includes output of all major crude mineral sources of phosphate. Table includes data available through Apr. 5, 1981.
[2]Reported figure.
[3]Includes material described as sedimentary rock in Soviet sources.
[4]Includes output from Western Sahara.

Table 34.—Leading world producers of marketable potash[1]

(K_2O equivalent, thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R	8,310	8,347	8,193	6,635	8,000
Canada	[r]5,215	[r]5,764	6,340	7,074	[2]7,532
German Democratic Republic	3,161	3,229	3,323	3,395	[2]3,422
Germany, Federal Republic of	2,036	2,341	2,470	2,690	[2]2,674
United States	2,177	2,229	2,253	2,225	[2]2,239
France	1,603	1,580	1,795	1,920	[2]1,939
Total	[r]22,502	[r]23,490	24,374	23,939	25,806
Other	[r]1,779	[r]1,666	1,799	1,994	2,065
Grand total	[r]24,281	[r]25,156	26,173	25,933	27,871

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Apr. 27, 1981.
[2]Reported figure.

Table 35.—Leading world producers of salt[1]

(Thousand metric tons)

Country	1976	1977	1978	1979[p]	1980[e]
United States (including Puerto Rico)	40,114	39,407	38,915	41,567	[2]36,631
China, mainland[e]	20,000	[r]17,100	19,530	14,770	[2]17,280
U.S.S.R.[e]	14,200	14,300	14,500	14,300	14,500
Germany, Federal Republic of	11,317	12,322	12,658	15,089	12,970
India	[r]4,599	[r]5,332	6,700	7,036	7,262
France	[r]5,889	[r]5,776	6,283	8,058	[2]7,103
Canada	5,994	6,039	6,452	6,881	7,029
United Kingdom	8,006	8,202	7,310	7,819	6,600
Mexico	4,591	[r]4,899	5,635	[e]5,600	6,000
Australia	5,489	4,715	5,766	5,800	[2]5,315
Italy	[r]4,012	5,030	4,931	5,669	5,267
Romania	4,210	4,536	4,739	4,720	4,720
Netherlands	3,026	3,111	2,939	3,951	[2]3,464
Poland	3,818	4,357	4,393	4,429	3,360
German Democratic Republic	2,560	2,643	2,741	3,052	3,140
Brazil	2,473	2,481	2,727	2,800	3,000
Spain	3,158	2,434	2,693	2,677	2,800
Turkey	579	777	929	1,130	1,100
Japan	1,021	1,056	1,073	1,090	1,090
Bangladesh	550	346	786	674	700
Egypt	480	597	755	616	700
Pakistan	519	499	640	704	699
Bahamas	1,353	1,670	1,633	440	[2]684
Argentina	[r]661	1,147	700	562	[2]627
Colombia	[r]1,111	922	751	634	620
Total	[r]149,730	[r]149,698	156,179	160,068	152,661
Other	[r]10,937	[r]11,190	10,749	11,785	12,091
Grand total	[r]160,667	[r]160,888	166,928	171,853	164,752

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through June 17, 1981.
[2]Reported figure.

Table 36.—Leading world producers of elemental sulfur[1]

(Thousand metric tons)

Country	1977				1978				1979[p]				1980[e]			
	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total	Native	From pyrite	Byproduct	Total
United States	[2]5,916	169	4,642	10,727	[2]5,648	301	5,226	11,175	[2]6,357	400	5,344	12,101	6,390	322	5,127	11,839
U.S.S.R.[e]	[3]2,900	3,500	3,340	9,740	[3]3,500	3,500	3,550	10,550	[3]3,500	3,500	3,550	10,550	3,700	3,550	3,650	10,900
Canada	--	12	[r]7,471	[r]7,483	--	5	7,242	7,247	--	12	7,015	7,027	--	12	7,393	7,405
Poland	[r]4,771	--	[r]379	[r]5,150	5,051	--	350	5,401	4,830	--	345	5,175	4,500	--	350	4,850
Japan	--	389	2,436	2,825	--	327	2,401	2,728	--	330	2,591	2,921	--	300	2,600	2,900
Mexico	[2]1,723	--	213	1,936	[2]1,818	--	235	2,053	[2]1,960	--	430	2,390	2,102	--	450	2,552
China, mainland[e]	[r]200	[r]1,252	300	1,752	200	1,605	350	2,155	200	[r]1,682	400	2,282	200	1,700	400	2,300
France	--	--	2,160	2,160	--	--	2,146	2,146	--	--	2,190	2,190	--	--	2,077	2,077
Germany, Federal Republic of	--	235	[r]1,392	[r]1,627	--	221	1,399	1,620	--	203	1,608	1,811	--	200	1,600	1,800
Saudi Arabia	1	--	12	13	1	--	14	15	1	--	125	126	1	--	700	701
Spain	--	1,102	136	1,238	--	1,071	130	1,201	--	1,019	133	1,152	--	1,100	140	1,240
Iraq	[2]620	--	[e]40	660	[2]600	--	40	640	[2]550	--	70	620	600	--	60	660
Italy	36	371	259	666	16	330	299	645	16	330	225	571	23	331	250	604
Romania	--	395	110	505	--	400	120	520	--	425	130	555	--	450	140	590
South Africa, Republic of	--	332	133	465	--	340	125	465	--	340	125	465	--	320	125	445
Finland	--	130	305	435	--	87	262	349	--	151	293	444	--	150	290	440
Sweden	--	204	165	369	--	233	148	381	--	240	150	390	--	240	150	390
Yugoslavia	--	166	205	371	--	170	207	377	--	190	207	397	--	190	198	388
Bulgaria	--	305	65	370	--	310	70	380	--	315	75	390	--	300	70	370
German Democratic Republic	--	10	340	350	--	10	350	360	--	10	350	360	--	10	350	360
Belgium	--	--	257	257	--	--	267	267	--	--	270	270	--	--	270	270
Korea, North	--	250	12	262	--	255	10	265	--	255	10	265	--	255	10	265
Iran	188	--	400	588	150	--	300	450	75	--	200	275	70	--	150	220
Norway	--	158	45	203	--	152	43	195	--	150	46	196	--	150	46	196
Netherlands	--	--	128	128	--	--	125	125	--	--	163	163	--	--	165	165
India	--	14	124	138	--	26	122	148	--	29	122	151	--	34	120	154
Australia	--	108	[r]126	[r]234	--	93	140	233	--	22	151	173	--	--	151	151
Total	[r]16,355	[r]9,102	[r]25,195	[r]50,652	16,984	9,436	25,671	52,091	17,489	9,603	26,318	53,410	17,596	9,614	27,032	54,232

See footnotes at end of table.

Table 36.—Leading world producers of elemental sulfur[1] —Continued

(Thousand metric tons)

Country	1977				1978				1979[p]				1980[e]			
	Native	From pyrite	Byprod-uct	Total	Native	From pyrite	Byprod-uct	Total	Native	From pyrite	Byprod-uct	Total	Native	From pyrite	Byprod-uct	Total
Other	[r]121	[r]573	[r]1,037	[r]1,731	121	537	1,199	1,857	219	507	1,071	1,797	114	535	1,186	1,845
Grand total	[r]16,476	[r]9,675	[r]26,232	[r]52,383	17,105	9,973	26,870	53,948	17,708	10,110	27,389	55,207	17,710	10,149	28,218	56,077

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Includes all recorded production of sulfur, regardless of the form in which it is recovered. Thus, it includes elemental sulfur, whether mined by conventional methods or by the Frasch process, as well as (1) elemental sulfur and the S content of compounds such as H_2S, SO_2, and H_2SO_4 recovered as a principal product of pyrite mining and as a byproduct of the recovery of crude oil and natural gas and as a byproduct of petroleum refining, coal treatment, and metal smelting and/or refining; and (2) sulfur recovered from tar sands, spent oxides, and other miscellaneous sources. Table includes data available through June 8, 1981.

[2]Entirely Frasch process sulfur.

[3]Includes Frasch process sulfur as follows, in thousand metric tons: Poland: 1977—4,321, 1978—4,546, 1979—4,310, and 1980—4,000; the U.S.S.R. (estimated): 1977—500, 1978—800, 1979—800, and 1980—900; and total of individually listed countries and grand total: 1977—13,080, 1978—13,412, 1979—14,277, and 1980—14,007. The balance is mined elemental sulfur.

Table 37.—Leading world producers of coal (all grades)[1]

(Million metric tons)

Country	1977			1978			1979[p]			1980[e]		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
United States	27	604	631	33	564	597	38	671	709	[2]42	[2]710	[2]752
U.S.S.R	167	555	722	166	557	723	165	554	719	[2]164	[2]552	[2]716
China, mainland	([3])	550	550	([3])	618	618	([3])	635	635	([3])	620	620
German Democratic Republic	254	([4])	254	253	([4])	253	256	--	256	[2]258	--	[2]258
Poland	41	186	227	41	193	234	38	201	239	[2]37	[2]193	[2]230
Germany, Federal Republic of	123	85	208	124	84	208	131	86	217	[2]130	[2]87	[2]217
United Kingdom	([5])	[r]122	122	([5])	124	124	([5])	123	123	--	130	130
Czechoslovakia	94	27	121	96	28	124	97	28	125	96	28	124
Australia	29	78	107	33	80	113	33	83	116	[2]33	[2]84	[2]117
South Africa, Republic of	--	85	85	--	90	90	--	104	104	--	[2]112	[2]112
India	4	100	104	4	102	106	3	104	107	4	106	110
Yugoslavia	39	1	40	39	([4])	39	42	([4])	42	[2]47	([2 4])	[2]47
Korea, North[e]	([3])	43	43	([3])	44	44	([3])	44	44	([3])	45	45
Canada	5	23	28	5	25	30	5	28	33	6	31	37
Romania	20	7	27	23	7	30	25	8	33	[2]27	[2]8	35
Bulgaria	25	([4])	25	26	([4])	26	28	([4])	28	31	([4])	31
Hungary	23	3	26	23	3	26	23	3	26	23	3	26
Greece	24	--	24	22	--	22	24	--	24	25	--	25
France	3	21	24	3	20	23	2	19	21	[2]3	[2]19	[2]22
Total	[r]878	[r]2,490	3,368	891	2,539	3,430	910	2,691	3,601	926	2,728	3,654
Other	[r]23	[r]98	[r]121	29	98	127	32	97	129	39	79	118
Grand total	[r]901	[r]2,588	[r]3,489	920	2,637	3,557	942	2,788	3,730	965	2,807	3,772

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Sept. 1, 1981.
[2]Reported figure.
[3]Output small; included under "Bituminous and anthracite."
[4]Less than 1/2 unit.
[5]Revised to zero.

Table 38.—Leading world producers of marketed natural gas[1]

(Billion cubic feet)

Country	1976	1977	1978	1979[p]	1980[e]
United States	[r]19,950	20,025	19,975	20,373	[2]19,992
U.S.S.R	11,334	12,219	13,144	14,359	[2]15,362
Canada	[r]3,007	[r]3,161	3,128	3,271	[2]3,320
Netherlands	3,436	3,422	3,133	3,292	[2]3,211
United Kingdom	1,316	1,416	1,382	1,410	[2]1,352
Romania	1,136	[r]1,204	1,212	1,161	1,203
Mexico	578	600	745	915	[2]1,129
Algeria	351	305	490	916	1,000
Germany, Federal Republic of	658	638	707	[e]725	[2]665
Venezuela	480	524	520	576	[2]589
China, mainland	[e]350	[e]425	485	512	484
Saudi Arabia	138	159	335	[e]400	450
Italy	552	485	485	476	435
Australia	209	217	259	296	[2]338
Brunei	299	314	308	292	[2]316
German Democratic Republic	305	300	302	302	302
Iran	794	[e]795	687	500	290
Argentina	272	275	260	284	270
Libya	[r]169	[r]178	181	240	260
Total	[r]45,334	[r]46,662	47,738	50,300	50,968
Other	[r]2,521	[r]3,256	3,667	4,197	4,582
Grand total	[r]47,855	[r]49,918	51,405	54,497	55,550

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Comprises all gas collected and utilized as a fuel or as a chemical industry raw material as well as that used for gas lift in fields, including gas used in oilfields and/or gasfields as a fuel by producers, even though it is not actually sold. Excludes gas produced and subsequently vented, flared, or reinjected to reservoirs. Table includes data available through Sept. 15, 1981.

[2]Reported figure.

Table 39.—Leading world producers of natural gas liquids[1]

(Million 42-gallon barrels)

Country[2]	1976	1977	1978	1979[p]	1980[e]
United States	587	[r]591	572	579	[3]572
U.S.S.R.[e]	[r]108	[r]114	[r]119	[r]122	[3]126
Canada	106	106	98	[3]102	[3]118
Saudi Arabia	66	70	91	[e]100	105
Mexico	34	38	44	57	[3]71
Algeria	[r e]18	[r e]21	[r e]32	34	32
Venezuela	29	[r]28	22	25	22
Kuwait	20	21	19	22	22
Total	[r]968	[r]989	997	1,041	1,068
Other	[r]102	[r]113	121	133	138
Grand total	[r]1,070	[r]1,102	1,118	1,174	1,206

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Every effort has been made to include only those natural gas liquids produced by natural gas processing plants and to exclude natural gas liquids obtained from field treatment facilities including wellhead separators, because the latter are normally blended with crude oil and thus are included in crude oil output statistics. In some cases, however, sources do not clearly specify whether data presented represent only output of natural gas processing plants or if they include field output. Thus, some of the figures may include field condensate. Table includes data available through Sept. 15, 1981.

[2]In addition to the countries listed, mainland China may also produce natural gas liquids, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

Table 40.—Leading world producers of crude oil[1]

(Million 42-gallon barrels)

Country	1976	1977	1978	1979[p]	1980[e]
U.S.S.R	3,820	4,011	4,201	4,304	[2]4,432
Saudi Arabia[3]	3,140	3,358	3,030	3,479	3,530
United States	2,976	3,009	3,178	3,114	[2]3,146
Iraq	882	857	935	1,252	961
Venezuela	840	817	790	860	[2]793
China, mainland[e]	[r]633	684	760	775	772
Nigeria	756	761	697	841	[2]754
Mexico	267	358	441	533	[2]708
Libya	707	753	721	754	[2]654
United Arab Emirates	709	730	668	663	[2]624
Kuwait[3]	[r]785	719	778	913	602
United Kingdom	85	279	389	562	[2]581
Iran	2,147	2,067	1,913	1,121	550
Indonesia	550	615	597	601	[2]537
Canada	489	482	478	545	[2]530
Algeria	[r]393	[r]421	424	421	398
Egypt	120	151	176	180	215
Argentina	146	[r]157	165	172	184
Norway	102	102	127	140	[2]182
Qatar	182	162	177	185	[2]173
Australia	153	157	158	160	[2]140
Oman	134	124	115	108	[2]105
Malaysia	61	67	79	103	[2]100
Brunei	74	77	77	[e]84	90
Romania	110	109	103	92	[2]86
India	65	76	83	94	80
Ecuador	68	67	78	78	78
Trinidad and Tobago	78	84	84	78	78
Peru	28	33	55	70	69
Brazil	63	59	59	62	[2]68
Syria	70	64	62	69	65
Gabon	82	[r]79	76	71	64
Total	[r]20,715	[r]21,489	21,674	22,484	21,349
Other	[r]374	[r]402	389	432	422
Grand total	[r]21,089	[r]21,891	22,063	22,916	21,771

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through Sept. 1, 1981.
[2]Reported figure.
[3]Includes the country's share of production from the Kuwait-Saudi Arabia Partitioned Zone.

Table 41.—Leading world producers of refined oil[1]

(Million 42-gallon barrels)

Country	1976	1977	1978	1979[p]	1980[e]
United States (including Puerto Rico and Virgin Islands)	5,479	5,923	5,957	5,860	5,700
U.S.S.R.	3,037	3,325	3,412	3,513	3,620
Japan	1,681	1,701	1,688	1,696	[2]1,611
France	902	[r]874	928	978	[2]881
Germany, Federal Republic of	821	772	788	953	[2]875
Italy	833	856	865	885	[2]713
Canada	625	659	664	712	[2]694
United Kingdom	723	638	726	725	[2]637
China, mainland[e]	548	650	600	620	620
Mexico	277	309	327	358	[2]425
Brazil	348	358	400	418	[2]405
Netherlands	490	448	427	453	[2]396
Spain (including Canary Islands)	376	355	351	355	356
Venezuela	361	356	362	367	[2]341
Saudi Arabia[3]	267	[r]275	294	315	[2]317
Singapore	173	217	250	264	[2]262
Belgium	213	269	250	240	[2]240
Australia	215	226	226	232	225
Netherlands Antilles	226	198	215	222	220
Indonesia	83	113	122	186	[2]193
India	168	181	196	203	191
Iran	255	274	249	[e]224	190
Romania	157	157	175	182	[2]186
Argentina	166	177	173	182	184
Korea, Republic of	132	158	174	189	[2]183
Kuwait[3]	134	126	133	156	154
Total	18,690	[r]19,595	19,952	20,488	19,819
Other	[r]2,666	[r]2,807	2,574	3,018	3,007
Grand total	[r]21,356	[r]22,402	22,526	23,506	22,826

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Sept. 1, 1981. Data comprise reported figures for the United States and Puerto Rico and an estimate for the Virgin Islands.

[2]Reported figure.

[3]Includes the country's share of production from the Kuwait-Saudi Arabia Partitioned Zone.

The Mineral Industry of Albania

By Walter Steblez[1]

1980 brought to a close Albania's sixth 5-year plan, which was shaped by policies of political nonalinement and economic self-sufficiency, following the breakoff of commercial relations with mainland China.

The country's planned economy registered production increases in 1980, however, only a few industrial sectors were able to meet their planned targets.

Albania's 1980 planned gross industrial output increased 7.1% over that of 1979, but was 30% below the planned goal. Revenues to the state budget, the main source for financing the national economy, increased 3.5%, resulting in a budget surplus of 80,000,000 leks.[2] Capital investment increased by 8.4% in 1980, and a number of industrial projects were completed and commissioned. Among these was the Rehove (Korçë District) copper beneficiation plant with a 2 1/2 year construction time, costing 16,165,000 leks, and with a reported 80,000-ton-per-year of ore capacity. Other projects included the completion of an electric furnace at the Laç copper pyrometallurgical plant; the Memaliaj phosphate processing plant in the Tepelenë District, costing a reported 4,000,000 leks (not including machinery and equipment); the laying of a petroleum pipeline for fuel export and the construction of Ballësh-Fier-Elbasan gas main, and the completion of a metal rolling mill at Kukës. In addition, the first stage of a olivenite refractory brick plant at the Elbasan metallurgical complex and the first stage of the new Prrenjas iron-nickel ore mine, designed to supply the Elbasan complex with ore, were completed.[3] It was reported that during the 5-year construction time of the Prrenjas Mine, in addition to the sinking of the mine shaft, rails and surface buildings, 11,000 meters of workings were constructed.

In the 1975-80 period, geological prospecting and exploratory drilling was conducted in 37 commercial ore deposits, constituting a reported 31% to 70% survey and exploration increase in solid minerals over the fifth 5-year plan (1970-75). There was also a 23% increase in the number of mine workings that were drifted in operating mines.[4]

Results of geological survey and exploration work conducted between 1976 and the first half of 1980 were analyzed, and technical studies prepared on nickel-free iron, radiometric assay, and bauxites; the study on polymetals, however, is to be carried over into the seventh 5-year plan period. The sixth 5-year plan survey and exploration activity is said to have determined new commercially viable deposits and corresponding mining sites for chrome, coal, nickel silicate, ferronickel, phosphorites, polymetals, bauxite, precious metals, argil, kaolin, iron, petroleum, natural gas, asbestos, and titanomagnetite.[5] In comparison with the previous 5-year plan period, when only 6 minerals were extracted, this plan period witnessed the extraction of 23 minerals, at 60 mines, of which 35 were reported to be open pits. In the seventh 5-year plan (1981-85), an expansion of Albania's mining industry is forecasted to include nickel-silicate, bauxite, polymetals, bituminous sands, asbestos, and titanomagnetite.

Together with these achievements, serious shortcomings were observed in both geological survey work and mining operations during this time. A lack of qualified technicians and specialists in the geological and mining sectors was a problem endemic to Albania's mineral economy. Professional qualifications of workers and employees in this field were reported to have not met

rated job requirements, and a number of accidents (without specific detail as to traumatism) were attributed to low competence levels of drill operators. Instances were cited in which machinery and equipment were not handled properly and not overhauled according to maintenance schedules at Belqizë (chrome), Burrel (chromë), Pukë (copper), and Rubic (copper) enterprises.[6] To improve the situation, special professional training programs have been instituted at various geological enterprises to upgrade drillers, equipment operators, miners, and other workers.

The best exploratory drilling results during the sixth 5-year plan, were achieved for ferrochrome at Tirana and Korçë, and for copper at Rubic, Pukë, and Kukës.

The overall volume of transportation in 1980 increased 4.4% over that of 1979, of which the volume of rail freight movement increased 9.9%. During this period, construction work proceeded with the help of young volunteers on the 22-kilometer Laç-Lezhe leg of the Laç-Shkoder Railroad project, designed to link the country's copper mining and copper processing areas. Furthermore, it was reported that construction started at a new port facility at Vlore. It is to have a 4,000,000-ton-per-year cargo handling capacity and is to be completed in 1985.

Government Policies and Programs.—In 1981, the gross industrial output is set to grow 7.2%; budget revenues are to increase 9.1%; total investment is to increase 5.8%; freight transportation is to grow 8.8%; industrial labor productivity is to increase 2.8%; and construction and installation work is to increase 4.9%.

In 1981, construction work will continue on the 600-megawatt Koman hydropower station on the Drin River; the "Steel of the Party" metallurgical complex in Elbasan; the new chrome and copper beneficiation plants at Diber, Pukë, and Midrite; and on the Laç-Shkoder Railroad. Plans call for the mining sector to make improvements in the utilization of mining equipment and beneficiation technology, and to reduce ore losses and dilution. In the petroleum sector, greater emphasis is to be placed on geological, geophysical, and seismological developments to raise drilling efficiency and increase discovery of new hydrocarbon reserves. Petroleum production is planned to increase 19% over that of 1980, which is to be based on further capital outlays for exploration, as well as on further development of recently discovered petroleum deposits.

The 1981 plan also provides for increases in coal output and electric power generation. The mechanization of coal mines is to be increased, and losses during extraction are to be significantly reduced. Furthermore, the 1981 plan requires improvement in the utilization of existing capacities in the chrome and steel industries.

PRODUCTION

In 1980, Albania produced more chrome ore, coal, blister copper, steel, rolled stock, and pig iron; more machine building industry products; and more electric power than in 1979. Domestic coke for nonferrous metallurgy was also produced for the first time. The 1980 planned output for petroleum, coal, and chrome ore, however, was not met.[7]

Currently, Albania has eight beneficiation plants: Three for copper, two for chrome, two for coal, and one for iron-nickel; plans are urgently being formulated for the design and construction of facilities for treating bauxite, polymetals, asbestos, and other minerals. Future Albanian plans also call for placing greater emphasis on the recovery of associated components. For example, complex copper-bearing ores are claimed to contain cobalt, sulfur, arsenic, zinc, selenium, tellurium, and precious metals in sufficient quantities to warrant their extraction during ore processing. At present, not all of these components are extracted, and greater effort is being extended to upgrade the technology for extracting the rest.

In 1980, 70% of the copper ore, 20% of the chromium ore, and 40% of the mined coal was beneficiated. Although coal extraction increased during the sixth 5-year plan, its treatment is unsatisfactory: Approximately 60% of the yield is consumed as uncleaned run-of-mine coal, thus reducing its caloric potential by 20% to 40%.[8]

Production shortfalls are generally attributed to the following factors: Labor shortages and a lack of skilled labor, the low quality of some of the domestically produced machinery and equipment, and construction bottlenecks.

In Albania, the material production labor force comprises approximately 87% of the total industrial labor force, and 16.3% of the total are involved in auxiliary work. In a number of mining enterprises, however, one-third to one-half of the workers are auxiliary, creating conditions for lower labor productivity at the enterprise level. The

mining industry also suffers from absenteeism, a problem that appears to plague the country's entire industrial work force. During the first 9 months of 1980, Albania's industrial losses, because of unjustified absenteeism, were 93,000 work days, or an average of 500 workers per day.[9]

Given significant world market price increases for imports of machine tools and producer durables, a number of complaints have been made concerning production waste and the low quality of Albania's domestically produced durable goods, including mining machinery. Steel conservation in the machine-building sector is described as an "unsolved problem," with the coefficient of steel utilization in the general range of 55% to 70%. The 1980 overruns for fuel and raw materials at machine-building enterprises were extensive and only 40% of the set standards for material and energy usage were met.

Construction bottlenecks also have had a detrimental impact on production. Considerable idle time and inefficient usage of bulldozers and excavators were alleged. Instances were reported where the work front was not prepared in advance, and machinery had to be transported to the work site at great expense and loss of time; such problems were reported to have occurred a number of times at the Belqizë chrome beneficiation plant.[10]

Timely delivery of cement presented further difficulties for the construction sector. For example, the Elbasan cement plant experienced both a lack of raw materials for cement production and transportation for delivery, which in both cases caused production stoppages at the cement plant and delays at construction sites.

Table 1.—Albania: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
Asphalt and bitumen, natural[e 3] thousand tons	1,350	1,500	1,600	1,650	1,780
Cement, hydraulic do	700	750	800	840	1,000
Chromium: Chromite, gross weight	830,000	880,000	990,000	1,015,000	1,077,000
Coal: Lignite[e] thousand tons	975	1,000	1,200	1,430	1,540
Cobalt, mine output, metal content[e 4]	287	306	306	306	330
Copper:					
Mine output, metal content[e]	10,000	10,000	11,500	14,000	15,300
Metal, primary and secondary:					
Smelter[e]	9,000	9,000	9,500	9,700	9,900
Refined[e]	7,000	7,000	7,000	7,500	7,700
Gas, natural, gross production[e 5] million cubic feet	12,370	12,370	12,500	13,000	13,200
Iron and steel:					
Iron ore: Nickeliferous:					
Gross weight	r479,000	r510,000	510,000	530,000	550,000
Iron content	167,600	178,500	178,500	85,500	192,500
Semimanufactures[e]	r25,000	r26,000	r27,000	r28,000	30,000
Nickel, mine output, metal content[e]	r4,800	r5,000	r5,100	r5,300	5,500
Nitrogen: N content of ammonia	r59,000	r65,000	76,000	72,000	75,000
Petroleum:					
Crude:					
As reported million tons	1,800	1,900	2,000	2,200	2,350
Converted thousand 42-gallon barrels	12,410	12,676	13,344	14,678	15,700
Refinery products:[e 6]					
Gasoline do	1,360	1,488	1,500	1,600	1,700
Kerosine do	388	465	470	500	540
Distillate fuel oil do	1,865	2,238	2,250	2,270	2,400
Residual fuel oil do	2,850	2,330	3,400	3,600	3,800
Lubricants do	84	84	90	100	105
Other do	2,100	2,400	2,500	2,600	2,700
Total[7] do	8,647	9,005	10,210	10,670	11,245
Salt[e]	50,000	50,000	50,000	62,500	66,500
Sodium compounds, n.e.s.: Sodium carbonate, calcined (soda ash)[e]	21,000	23,000	r23,200	r23,300	25,000

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Sept. 21, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (common clay, sand and gravel, and stone) is undoubtedly produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels. Also, metallic nickel production reportedly began in 1978, but data on the level of production are not available.

[3]Includes petroleum refinery-produced asphalt and bitumen.

[4]Calculated from reported and estimated weight of nickeliferous ore; the amount of cobalt recovered, if any, is conjectural.

[5]Separate data on marketable production are not available, but gross and marketed output are regarded as nearly equal.

[6]Based on estimated tonnages reported in United Nations, World Energy Supplies 1972-76. Statistical Papers, ser. J, No. 21, New York, 1978, 233 pp.

[7]Sums of listed products only; no estimates have been made for other products produced.

TRADE

In 1980, Albania maintained a foreign commercial policy forbidding foreign credit borrowing, joint industrial ventures, mixed enterprises, and similar routine international business transactions, stipulating trade on a bilateral import-export basis only.

During the sixth 5-year plan period (1976-80), Albania increased exports by a total of 33%, or 3% to 4% above the planned level. Processed and semiprocessed commodities accounted for 70% of the total exports, and products such as gas oil, ferrochrome, pyrite concentrate and ore, coal, urea, and newsprint were exported for the first time. The 1980 export plan, however, was not met.

In 1981, the total volume of exports is expected to grow 18%, and during the seventh 5-year plan, exports of petroleum products, electric power, and minerals are planned to increase.

Currently, two-thirds of Albania's import funds are allocated toward the procurement of raw materials and one-third for essential machinery and equipment. The Eighth Plenum of the Party Central Committee of Albania set measures to alter this ratio in favor of reducing purchases of raw materials and increasing imports of machinery and equipment to upgrade domestic industrial output.[11]

In 1980, Yugoslavia remained Albania's principal trading partner, with a reported $170 million turnover. Trade between the two countries is extensive and, in part, consists of Albanian exports of chromium ore, petroleum, asphalt, copper wire, sulfur, gasoline, electric power, and consumer goods in exchange for steel strip, steel wire, cable and sheets, pipes, ferrous and nonferrous metals, transportation and communication equipment, and consumer goods. However, in light of the strained political atmosphere created by episodes of national irredentism of Kosovo's (Yugoslavia) Albanian population, the further development of Albanian-Yugoslav trade relations faces an uncertain future.

Among Albania's other trading partners in 1980 were Austria, which imported copper in exchange for paper and steel, and Romania, which imported Albanian oil in exchange for oilfield equipment. In 1980, Albania was reported to have held talks with Spain regarding the possible purchase of Albanian chrome ore and ferrochrome and a reported 1,700 tons of hot coil was imported by Albania from Spain. Also, Albania was reported to have purchased a merchant mill to expand its facilities at the Elbasan metallurgical complex in 1980 from the Italian manufacturer Danieli. During 1980, the United States continued to export low-volatile bituminous coal to Albania in exchange for chrome ore.

As part of its 1981 foreign trade plan, Albania signed an agreement with Turkey calling for imports of industrial goods and agricultural produce in exchange for chemical products; its trade agreement with Czechoslovakia calls for imports of vehicles and machine tools in exchange for agricultural produce and consumer goods. A 1981 trade agreement with Poland calls for Albanian import of mining machines and equipment, electrotechnical equipment, metallurgical installations, automotive industry products, coking coal, rolled products, refractories, and other goods in exchange for asphalt, chromium ore, cables and copper conduits, agricultural produce, and consumer goods.

Table 2.—Albania: Apparent exports of mineral commodities [1] [2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum metal including alloys, unwrought	40	--	
Chromium: Chromite ------- thousand tons	255	868	Sweden 207; Yugoslavia 200; West Germany 182.
Copper metal including alloys:			
Unwrought	3,432	918	Austria 397; Italy 200; Portugal 150.
Semimanufactures	200	376	Turkey 356.
Iron and steel metal:			
Ferroalloys	--	155	All to Algeria.
Steel, primary forms	6,000	--	
Semimanufactures:			
Bars, rods, angles, shapes, sections	--	1,067	Egypt 484; Turkey 395.
Universals, plates, sheets	23	--	
Hoop and strip	20	--	
Tubes, pipes, fittings	--	13	Saudi Arabia 12.
Castings and forgings, rough	--	9	All to Saudi Arabia.

See footnotes at end of table.

Table 2.—Albania: Apparent exports of mineral commodities [1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Silver waste and sweepings _ value, thousands	$100	$445	All to Italy.
Tin metal including alloys, semimanufactures	--	1	All to Egypt.
Tungsten ore and concentrate	4,004	--	
Other base metals including alloys, all forms	--	2	All to Saudi Arabia.
NONMETALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	--	2	Do.
Cement	6,154	33,678	Algeria 19,998; Yugoslavia 13,680.
Fertilizer materials: Manufactured, nitrogenous _	--	2,151	Greece 2,132.
Salt	3,787	22,948	Hungary 17,804; Yugoslavia 5,144.
Sodium and potassium compounds, n.e.s.: Soda ash	5,209	2,615	Italy 1,935; Greece 590.
Stone, sand and gravel:			
Dimension stone	4,025	5,635	Algeria 4,586; Poland 929.
Gravel and crushed rock	--	4	All to Saudi Arabia.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	515	2,602	Turkey 1,602; Yugoslavia 1,000.
Coke and semicoke	15	--	
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	r96	361	All to Italy.
Kerosine do	r4	(3)	All to Hungary.
Distillate fuel oil do	(3)	218	Italy 156; Greece 60.
Other:			
Bitumen and other residues do	r419	570	Greece 244; Italy 209; Turkey 64.
Unspecified do	294	322	All to Poland.

rRevised.

[1] Owing to the lack of official trade data published by Albania, this table should not be taken as a complete presentation of Albania's mineral exports. These data have been compiled from various sources which include United Nations' information and data published by the partner trade countries.

[2] Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3] Less than 1/2 unit.

Table 3.—Albania: Apparent imports of mineral commodities [1] [2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite	2	--	
Metal including alloys:			
Unwrought	500	595	Hungary 498; Greece 97.
Semimanufactures	539	793	Hungary 395; Yugoslavia 369.
Copper:			
Sulfate	332	100	All from Yugoslavia.
Metal including alloys:			
Unwrought	--	26	All from West Germany.
Semimanufactures	565	190	West Germany 96; Italy 31; Greece 30.
Iron and steel:			
Ore and concentrate	r10,000	--	
Metal:			
Pig iron	10	--	
Ferroalloys	1,960	4,818	Yugoslavia 4,369; Portugal 171.
Semimanufactures:			
Bars, rods, angles, shapes, sections	34,724	28,093	Poland 21,401; Yugoslavia 2,999.
Universals, plates, sheets	8,593	10,096	Poland 3,264; Hungary 2,792; West Germany 1,860.
Hoop and strip	438	303	West Germany 83; France 80; Italy 63; Turkey 60.
Wire	384	615	Greece 260; Austria 134; Japan 117.
Lead metal including alloys:			
Unwrought	144	190	All from Yugoslavia.
Semimanufactures	--	166	Yugoslavia 97; West Germany 69.
Magnesium metal including alloys, semimanufactures	--	4	All from West Germany.
Manganese:			
Ore and concentrate	--	4,072	Turkey 3,150; Yugoslavia 922.
Oxides	50	1	All from the United Kingdom.
Mercury 76-pound flasks	--	1,073	All from Algeria.
Nickel metal including alloys, unwrought	1	8	All from the Netherlands.
Silver metal including alloys, unwrought or partly wrought value, thousands	--	$6	All from Yugoslavia.
Tungsten metal including alloys, all forms kilograms	400	--	

See footnotes at end of table.

Table 3.—Albania: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Zinc:			
Oxide and peroxide	46	67	All from Italy.
Metal including alloys:			
Unwrought	r164	194	All from Algeria.
Semimanufactures	37	116	All from Yugoslavia.
Other:			
Ores and concentrates	70	148,963	Algeria 148,903.
Oxides, hydroxides, peroxides	1	--	
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	6	5	All from Italy.
Grinding and polishing wheels and stones	4	67	Yugoslavia 51; Italy 13.
Asbestos	1,369	1,675	Yugoslavia 1,657.
Boron oxide and acid	7	7	Yugoslavia 6.
Clay and clay products:			
Crude clay	68	13	West Germany 11.
Products:			
Refractory	16,778	25,157	Yugoslavia 15,905; Hungary 4,092; Poland 3,354.
Nonrefractory	35	1	All from Italy.
Feldspar and fluorspar	2,319	2,336	France 2,261; Greece 73.
Fertilizer materials:			
Crude, phosphatic	r29,750	62,160	Algeria 46,160; Egypt 16,000.[3]
Manufactured:			
Nitrogenous	1	2	All from West Germany.
Potassic	2,488	4,378	All from Italy.
Ammonia	--	1	All from West Germany.
Magnesite	9	8	Do.
Mica, worked	1	--	
Pigments, mineral: Iron oxides, processed	26	--	
Salt	10	1	All from West Germany.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	1	2	All from West Germany.
Caustic potash	--	34	All from Yugoslavia.
Soda ash	--	2	All from West Germany.
Stone, sand and gravel:			
Dimension stone	57	--	
Quartz and quartzite	8	27	All from West Germany.
Sand excluding metal-bearing	755	957	All from Yugoslavia.
Sulfur: Sulfuric acid	9,135	974	Greece 960.
Talc	263	886	Yugoslavia 590; Italy 198.
Other:			
Crude	100	199	All from Greece.
Halogens	1	--	
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	23	3	All from West Germany.
Coal, all grades	168	261	United States 182; West Germany 79.
Coke and semicoke	9	21	France 11; Poland 10.
Petroleum refinery products:			
Gasoline	--	8	All from Italy.
Kerosine	--	82	All from Algeria.
Distillate fuel oil	r26	23	Do.
Residual fuel oil	--	4	All from Yugoslavia.
Lubricants	10	33	All from Italy.
Other:			
Liquefied petroleum gas	r12	--	
Mineral jelly and wax	r79	2,377	West Germany 1,574; Yugoslavia 787.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	--	5	All from West Germany.

rRevised.

[1]Owing to the lack of official trade data published by Albania, this table should not be taken as a complete presentation of Albania's mineral imports. These data have been compiled from various sources which include United Nations' information and data published by the partner trade countries.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Statistical Supplement, published half-yearly by the British Sulphur Corporation Limited, London, United Kingdom.

COMMODITY REVIEW

METALS

Chromite.—In 1980, Albania remained the world's third largest producer of chromite, with 15 operating mines. Production of chromite has been growing steadily over the sixth 5-year plan, although the 1980 production plan was not met.

Albanian ore is mainly exported at a current 42% Cr_2O_3 average grade level. The chief importers of Albanian ore are Yugoslavia, the Federal Republic of Germany, Poland and Romania. Domestic consumption is small, but steadily increasing: Chromium ore is used chiefly for refractories and ferrochrome production.

With the breakoff of commercial relations with mainland China, Albania found itself short of skilled personnel, which had a negative impact on the general economy including the chromium industry. In recent years, the chromium content of Albania's exported ore decreased from 51% to an average 42% to 43%.[12]

Marketable Albanian ore is generally viewed as a less expensive product in respect to metal content and having lower freight rates. However, assays occasionally have differed substantially from contract specifications. Reportedly, buyers are permitted to make quayside preshipment inspections and have often been provided with high-graded samples of ore differing markedly from the rest of the consignment.[13]

This policy has led to a wide variety of comments from consumers, ranging from *caveat emptor* to high marks for good quality. Since chrome ore is the country's chief source of foreign exchange, Albanian sources have expressed concern regarding chrome ore quality by calling for improved grading of ore and for the reduction of ore dilution to assure its marketability. Significantly, average annual mine losses of chromite amount to 10% to 15%.

Furthermore, in 1980 the construction of a new chrome beneficiation plant was begun at Belqizë.

Copper.—The copper extraction and processing industry with beneficiation, smelting, and refining facilities is one of the more developed branches of Albanian mineral industry. In 1980, Albanian copper products designated for export consisted of 85% refined and 15% blister copper, and the planned output for the industry in 1980 was fulfilled. These achievements did not prevent criticism of the industry for high-grading rich ore deposits, leaving 15% to 20% of the reserves unmined and out of reach of mining machinery and, consequently, raising production costs. The smelting of unbeneficiated copper ore was also criticized because this resulted in the loss of pyrite which might have been used to manufacture sulfuric acid. For this reason, emphasis is being given for the expansion of the industry's beneficiation capacity. Apart from the newly commissioned concentrator at Rehove, the construction of a beneficiation plant at Pukë, scheduled to go on-stream in 1980, is to continue in 1981.

Iron Ore (Nickeliferous).—In 1980, Albania mined a little over one-half million tons of iron ore, which is primarily used to supply the Elbasan metallurgical complex. The ore contains sufficient quantities of nickel and cobalt to warrant extraction by means of recently expanded capacities at this facility. With the completion of the second stage of Prrenjas Mine and achievement of its full capacity, the output of nickeliferous iron ore is expected to increase 2.5 times compared with the sixth 5-year plan output levels. However, if full production capacities are to be achieved, significant improvements in the efficiency of mining operations will be required; currently mining losses of iron-nickel ore are in the range of 26% to 30% for the industry.

Iron and Steel.—In 1980, production increases were reported for pig iron, steel, and rolled stock. Expanded facilities included a second blast furnace, a second coking battery, a rolling mill, and a refractory plant at the Elbasan complex. Although Albania, in past years, expanded its variety of steels, it nevertheless did not produce all of the grade steels required by the machine-building industry, thereby necessitating imports of steel and equipment. In 1980, Albania reportedly began producing ferrochromium at Burrel and offering some of it on the international market.

NONMETALS

Cement.—The Albanian cement industry, located at Elbasan, Fushe-Kruje, Shkoder, Tirana, and Vlore, in the western part of the country, did not meet the 1980 production plan. Production delays were attributed to snags in raw materials delivery and

transportation.

Fertilizer Materials.—In 1980, Albania put onstream a phosphate rock grinding plant in Memaliaj (Teplenë District), for the production of fertilizer. Although unspecified phosphorite reserves were discovered during the sixth 5-year plan, currently all raw material supplies are imported from Algeria and Egypt, and are used in fertilizer production at the 30,000-ton-per-year Durres superphosphate plant. In addition, nitrogenous fertilizer is manufactured at the Fier urea plant.

MINERAL FUELS

In 1980, Albania remained self-sufficient in energy production and was a net exporter of hydrocarbons and electric power.

Hydroelectric power provides Albania with 80% of its electricity requirements, with only 20% of the country's hydroelectric power potential utilized in 1980. With the completion of the Fierze power station on the Drin River in 1979, work continued on the 600-megawatt Koman hydropower station in 1980—the third of the projected five hydroelectric power stations on the Drin River. In view of Albania's efforts to develop a domestic aluminum industry, hydroelectric power is to play a significant role in its economic development during the seventh 5-year plan.

Table 4.—Albania: Estimated total primary energy balance, 1979 and 1980

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (lignite, anthracite, bituminous) coke	Crude oil and petroleum products	Natural and associated gas	Hydropower
1979:[2]					
Production	3.77	0.72	2.30	0.49	0.26
Imports	.12	.12	--	--	--
Exports	.18	.01	.10	--	.07
Apparent consumption	3.71	.83	2.20	.49	.19
1980:[2]					
Production	3.65	.79	2.06	.49	.31
Imports	.12	.12	--	--	--
Exports	.19	.01	.10	--	.08
Apparent consumption	3.58	.90	1.96	.49	.23

[1]1 ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are: Lignite, 0.7; crude oil, 1.47; natural gas, 1.33 (per 1,000 cubic meters); hydroelectric power, 0.125 (per kilowatt-hour).
[2]Estimates based on data from various Albanian sources.

Source: United Nations—World Energy Supplies. Statistical papers, Series J, No. 18, 1976.

Coal.—In 1980, the Memaliaj (Teplenë District) and the Mborje-Drenova (Korçë District) coal mines underwent expansion and modernizaton, and the development of five new mines was commenced in the Tirana, Pogradec, Korçë, and Kolonja Districts. This was part of an effort to meet a planned coal output increase of 25%. However, owing to shortages of labor and other unspecified problems, only 40% of the coal production plan was met in 1980. Coal mine losses in 1980 amounted to 20%.

Natural Gas.—New unspecified gas deposits were claimed to have been discovered in 1980. Gas is consumed domestically by the chemical sectors of the economy and by thermal electric power generating units. Albania's current estimated natural gas reserves are under 12 billion cubic meters.

Petroleum.—Albania's petroleum industry not only failed to meet the 1980 plan target, but also produced crude at about twice the 1960 level or under 1.5 million tons per year, which falls significantly below previous output estimates. This industry has been negatively affected by a lack of skilled labor, shortages of refinery capacity, and spare parts for drilling equipment. Many of the old oilfields are nearing depletion and are contributing only 0.25% of the total crude output, and the planned 19% production increase in 1981 is expected to be met by increasing production from newer fields as well as by putting onstream recently discovered reserves.

[1]Foreign mineral specialist, Branch of Foreign Data.
[2]In December 1980, lek 5=US$1.00.
[3]Zeri i Popullit (Tirana). Mar. 27, 1981, pp. 1-3.
[4]Albania Today. No. 6, No. 55, 1980, p. 19.
[5]Rruga E Partise (Tirana). November 1980, pp. 15-23.
[6]Work cited in footnote 3.
[7]Zeri i Popullit (Tirana). Mar. 27, 1981, pp. 3-4.
[8]Work cited in footnote 3.
[9]Probleme Ekonomika (Economic Issues). No. 2, April-June 1980, pp. 53-58.
[10]Bashkimi (The Union), (Tirana). Sept. 26, 1980, p. 1.
[11]Zeri i Popullit (Tirana). Oct. 22, 1980, p. 1.
[12]Handelsblatt (Duesseldorf). July 3, 1980, p. 7.
[13]Journal of Commerce. Dec. 16, 1980, p. 4.

The Mineral Industry of Algeria

By Suzann C. Ambrosio[1]

The hydrocarbon sector continued to dominate the mineral industry and fuel the Algerian economy during 1980. Petroleum and natural gas accounted for approximately 40% of the total gross domestic product (GDP), estimated at $36 billion in 1980.[2] Mining and manufacturing comprised nearly 15% of the GDP, with iron, steel, and fertilizers representing the leading industries. Other minerals produced, including cement, mercury, lead, and zinc, continued to be significant in the development of Algeria's heavy industries.

Algeria was the third largest crude oil producer and the largest natural gas producer in Africa during 1980. Only 4% of the Organization of Arab Petroleum Exporting Countries' total oil production was contributed by Algeria. Although production of liquefied natural gas (LNG) was stable between 1977 and 1980, the ratio of exports to production declined throughout the period. Algeria's proven gas reserves were the fourth largest in the world. The natural gas reserves, estimated at 105 trillion cubic feet, were equivalent to nearly two-thirds of the country's proven hydrocarbon reserves. Crude oil reserves were projected to last less than 20 years even though phased production cuts of 10% to 15% were expected to occur in subsequent years.

Petroleum production has apparently peaked, and future rates of economic growth were expected to hinge on the exploitation of natural gas resources and development of the agricultural sector. The new 5-year plan, 1980-85, envisioned a growth rate of 8.2% for real GDP, with industry growing at 12% to 13% per year and agriculture growing at 4% per year. Although the Algerian Government does not publish GDP statistics, 1980 estimates compared with 1979 were reported to have increased 18% to $36 billion for nominal GDP and increased 5% to 1.9 billion for real GDP, measured in constant 1974 prices.[3] The decline in the growth rate of real GDP in 1980 reflected the decrease in crude oil production.

Over 95% of the Government's current revenues were derived from petroleum exports. During the period between 1973 and 1979, revenues increased nearly fivefold to $13 billion. Hydrocarbon export receipts increased over 50% for the second straight year in 1980, and provided 90% of the country's foreign exchange earnings. In December 1980, crude oil was priced at $37 per barrel and the interim natural gas price was $4.60 per thousand cubic feet. Algeria's trade surplus increased to approximately $2.3 billion in 1980, despite the sustained growth in imported goods and services. The 1980 rate of growth of goods and services at 1979 prices was 50%, where food product imports increased by 45% and capital goods rose by 33%.

The new 1980-85 development plan projected investments worth $104 billion over the entire period. Hydrocarbon exports were expected to be capable of financing 60% of the country's 1981 budget, which was approved at $21.7 billion. Although a large share of the allocations were expected to continue to be made to industry (36%), agricultural and social programs received greater emphasis in the new 5-year plan. Expenditures for housing and education were expected to increase sharply to nearly one-third of the total budget. Agriculture investments were projected to nearly double the levels in the previous plan. The ratio of expenditures of hydrocarbons to other industries was expected to rapidly decline

from 65% in 1980 to 33% in 1984. This was expected to correspond with a steady increase in the volume of new investments for total industry. Greater attention was given to light industries and infrastructure, with the private sector expected to play a larger role in their development, along with consumer goods, tourism, and retail trade.

In review of the previous 5-year plan, the Algerian Goverment recognized the need to consolidate and improve the efficiency of State-run organizations. New policy initiatives imposed greater financial controls on nationalized industries, including the Société Nationale de Recherches et d'Exploitations Minières (SONAREM), Société Algerienne de Electricité et du Gaz (SONELGAZ), and Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocabures (SONATRACH). As part of the effort to decentralize Government decision-making, the hydrocabon monopoly SONATRACH was the first among other targeted agencies to be split up.

In May 1980, SONATRACH was trimmed and new companies were formed; Entreprise Nationale des Grands Travaux Pétrolières, Entreprise Nationale de Raffinage et de Distribution des Produits Pétrolières, and Entreprise Nationale des Plastiques et Caoutchouc. The three companies were expected to study and implement petroleum industrial projects; process, distribute, and export oil and gas; and produce and sell petrochemical products. SONATRACH retained responsibility for exploring, producing, transporting, and selling hydrocarbons on the international market. These interim organizations were expected to undergo further decentralization during 1981.

The labor problems associated with the reorganization schemes and the dismissal of many senior officials at SONATRACH since 1979 have adversely affected hydrocarbon and other industrial production. The total number of energy and petrochemical workers was 120,000 during 1980. SONATRACH employment, comprising nearly 80% of the total, was projected to increase to 125,000 by 1984. Work force inadequacies were expected to continue, since training facilities and skills distribution within most of Algeria's industries were deficient.

PRODUCTION AND TRADE

Mineral production in the nonhydrocarbon sector remained stable over the past decade. Major deposits of iron, mercury, lead, zinc, and phosphates and smaller deposits of copper, barite, salt, clays, and rare earths were exploited during 1980. Approximately 60% of the mineral output was consumed locally and an estimated $50 million in foreign exchange was attributed to 1980 nonhydrocarbon mineral exports.

Iron ore, steel, cement, and fertilizer output increased to meet rising domestic demands. Facility expansions planned for and constructed during 1978 through 1980, were primarily responsible for increased production and corresponding declines in the growth of mineral imports. Production capacities achieved at the new facilities were rated beween 40% to 75%. Inadequacies in transportation, storage capacity, and lack of skilled labor adversely affected production and trade in most mineral industries.

Production of crude oil declined by approximately 9.4% during 1980, while the proportions of condensate and other refined petroleum products increased over 1979 levels. The Skikda refinery was completed in August 1980. Algeria's refinery capacity was increased by 300,000 barrels per day and plans were made to expand the facility by another 400,000 barrels per day. The nature of Algeria's light crude was such that various refinery products, such as tar, could not be produced in sufficient quantities and were therefore imported.

Natural gas production declined slightly during 1980 because operations ceased at the largest liquefaction plant. However, less gas was flared and production capacities of liquefaction units were increased overall. The Arzew 3 LNG project was cancelled and a shift in exporting gas in its nonliquefied form to Europe was expected. During 1980, the export capacities for natural gas facilities in place and under construction, were 1,165 billion cubic feet of LNG and 530 billion cubic feet of liquefied petroleum gas (LPG). The Algerian-Italy trans-Mediterranean pipeline when completed was expected to transport an additional 1,518 billion cubic feet of LNG per year.

Petroleum products comprised 97% of Algeria's total exports. Hydrocarbon export receipts in 1980 increased 58% over 1979

levels to nearly $13 billion. The distribution of revenues were: 71.4% crude oil, 10.2% condensate, 12.2% refined products, and 6.2% LNG. Projections for 1981 were estimated to reach $18 billion, with increased revenues expected primarily from natural gas and refined products.

The majority of SONATRACH's investments have been devoted to hydrocarbon activities linked to exports. Approximately 62% of the sector's total investment of $94 billion went to exports and related activities, over the second development period, 1974-79. Exports of LNG during the same interval increased by 17%, while LPG increased by 70%.

The United States imported approximately 486,000 barrels per day of Algerian crude oil in 1980. This was equivalent to 7.2% of the total U.S. crude imports and nearly half of Algeria's production. In addition, the United States had long-term LNG contracts for approximately 1 billion cubic feet per day. U.S. petroleum imports declined however in 1980 because of the LNG pricing disputes. Although Algeria imported grains, mechanical machinery, iron and steel products, and construction and mining machinery, the U.S. trade deficit increased by 33% to over $6 billion during 1980.

Table 1.—Algeria: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Cadmium, refined	29	133	175	185	150
Copper concentrate:					
Gross weight	[e]1,600	1,500	679	870	1,048
Metal content	[e]370	345	157	200	[3]240
Iron and steel:					
Iron ore, gross weight thousand tons	2,800	3,182	3,052	3,200	3,800
Metal:					
Pig iron do	455	429	455	480	575
Crude steel do	356	[r]410	580	417	[3]534
Semimanufactures do	[e]171	NA	NA	NA	NA
Lead concentrate:					
Gross weight	3,000	1,362	2,837	3,594	3,750
Metal content	2,100	875	1,825	2,300	[3]2,400
Mercury 76-pound flasks	30,915	30,429	30,603	14,736	[3]24,425
Silver[e] thousand troy ounces	80	40	75	100	100
Zinc:					
Concentrate:					
Gross weight	14,283	5,762	9,981	10,210	17,100
Metal content	6,856	2,748	4,790	4,900	[3]8,200
Metal, smelter	20,000	20,000	25,700	17,000	30,000
NONMETALS					
Barite, crude	75,000	48,066	73,087	[e]90,000	90,000
Cement, hydraulic thousand tons	1,400	1,777	2,697	3,768	4,000
Clays:					
Bentonite	24,514	24,400	35,664	[e]36,500	36,500
Fuller's earth	3,200	4,367	4,847	[e]5,000	5,000
Kaolin	7,784	11,465	17,423	[e]18,100	18,000
Diatomite	4,321	4,100	4,025	[e]4,000	4,000
Gypsum and plasters[e 4] thousand tons	175	175	175	191	200
Lime, hydraulic do	33	40	[e]50	[e]82	90
Phosphate rock do	742	1,173	1,136	1,084	[3]1,025
Salt do	136	147	171	[e]165	170
Sodium compounds: Caustic soda	696	688	[e]700	[e]700	700
Strontium minerals: Celestite, gross weight	6,483	5,100	5,822	[e]5,400	5,400
Sulfur, elemental[e]	9,876	10,000	15,000	15,000	14,000
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand tons	[e]1	--	--	--	--
Gas, natural:					
Gross million cubic feet	863,051	939,118	1,148,322	1,539,006	[3]1,497,511
Marketed (including liquefied) do	350,779	[r]304,905	490,095	916,023	900,000
Natural gas plant liquids (condensate)[e] thousand 42-gallon barrels	18,000	20,800	32,200	33,872	32,000
Petroleum:					
Crude do	[r 5]393,487	[r 5]420,577	440,500	439,350	398,000
Refinery products:					
Gasoline do	6,893	[r]9,892	10,914	11,315	NA
Jet fuel and kerosine do	3,144	[r]3,066	4,453	4,380	NA
Distillate fuel oil do	10,580	[r]9,746	15,732	16,790	NA
Residual fuel oil do	9,222	[r]7,337	12,447	12,775	NA

See footnotes at end of table.

Table 1.—Algeria: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Lubricants thousand 42-gallon barrels	128	228	362	365	NA
Other do	6,522	[r]2,033	7,594	10,220	NA
Refinery fuel and losses do	894	[r]2,008	5,365	2,555	NA
Total do	37,383	[r]34,310	56,867	58,400	95,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 25, 1981.

[2]In addition to the commodities listed, secondary aluminum, secondary lead, and secondary copper may be produced in small quantities, ammonia is produced, and crude construction materials additional to those listed presumably are produced for local consumption, but output is not reported and available information is inadequate to make reliable estimates of output level.

[3]Reported figure.

[4]Includes approximately 50,000 tons of plasters each year.

[5]Includes lease condensate.

Table 2.—Algeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, scrap	585	51	--	All to France.
Cadmium metal including alloys, all forms	20	--		
Copper:				
Ore and concentrate	1,000	800	--	All to Bulgaria.
Metal including alloys, all forms	4,489	1,501	--	All to France.
Iron and steel:				
Ore and concentrate thousand tons	1,434	1,528	--	Belgium-Luxembourg 665; Romania 381; Italy 272; Czechoslovakia 129.
Pyrite, roasted	--	20,000	--	All to West Germany.
Metal:				
Scrap	74,246	82,474	--	Italy 62,022; Spain 18,411; Belgium-Luxembourg 2,000.
Pig iron, ferroalloys, similar materials	95,147	102,300	--	Italy 39,000; Republic of Korea 15,000; Qatar 10,500; Indonesia 10,300.
Semimanufactures	38,811	34,138	--	Italy 26,733; Belgium-Luxembourg 7,405.
Lead:				
Ore and concentrate	2,682	1,000	--	All to Tunisia.
Metal including alloys, scrap	790	--		
Magnesium metal including alloys, scrap	--	6	--	All to France.
Mercury 76-pound flasks	[r]264,704	406,410	232,875	Japan 54,510; East Germany 34,500; West Germany 28,875.
Nickel metal including alloys, all forms	20	--		
Zinc:				
Matte	523	79	--	All to France.
Other waste containing zinc	477	--		
Metal including alloys, all forms	[r]14,496	17,779	4,043	Netherlands 9,429; France 2,653; Nigeria 1,032.
Other: Ash and residue containing nonferrous metals	--	130	--	All to France.
NONMETALS				
Abrasives: Grinding and polishing wheels and stones	1	--		
Clay and clay products:				
Crude clays: Kaolin and bentonite	150	100	--	All to Tunisia.
Products: Refractory including nonclay brick	--	5,988	--	All to U.S.S.R.
Diamond, industrial carats	--	20,000	--	All to Ireland.
Diatomite and other infusorial earth	795	2,445	--	France 2,000; Belgium-Luxembourg 400; United Kingdom 20.
Fertilizer materials: Crude, phosphatic	775,501	614,450	--	U.S.S.R. 85,000; Finland 84,000; Poland 73,500; France 55,900.
Graphite, natural	--	300	--	All to France.
Gypsum and plasters	20	--		
Salt	4,400	--		
Stone, sand and gravel: Dolomite, crude	--	2,000	--	All to Italy.

See footnotes at end of table.

Table 2.—Algeria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Sulfur: Sulfuric acid	33,935	10,784	--	Italy 6,111; Spain 4,673.
Other:				
Crude	5,363	2,080	--	All to Italy.
Alkali, alkaline earth, rare-earth metals: Cerium	755	245	110	United Kingdom 41; West Germany 38; Japan 21.
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural, liquefied[1] thousand tons	3,317	5,145	1,884	France 2,192; United Kingdom 521; Spain 459.
Peat including briquets and litter	--	65,389	--	All to France.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	363,565	364,202	199,004	West Germany 56,307; France 34,773; Italy 27,978.
Refinery products:				
Gasoline do	3,122	3,710	223	Netherlands 2,120; Belgium-Luxembourg 1,145; United Kingdom 154.
Jet fuel and kerosine do	805	180	--	Greece 141; Dahomey 39.
Distillate fuel oil do	787	405	1	Greece 91; Dahomey 71; Cyprus 36.
Residual fuel oil do	r4,427	5,029	4,552	Italy 385; Greece 43.
Nonlubricating oils, n.e.s do	--	9	--	Mainly to Greece.
Total do	r9,141	9,333		

rRevised.
[1]Liquefied natural gas and liquefied petroleum gas together, not differentiated.

Table 3.—Algeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	9,550	2	--	All from France.
Oxide and hydroxide	248	1,278	14	Italy 906; Switzerland 300; France 33.
Metal including alloys, all forms	10,173	11,851	563	Italy 2,981; West Germany 2,253; Belgium-Luxembourg 1,758; France 1,238.
Antimony metal including alloys, all forms	115	35	--	Bolivia 20; United Kingdom 10.
Arsenic oxides and acids	80	--		
Chromium oxides and hydroxides	19	53	--	West Germany 25; Switzerland 16; Belgium-Luxembourg 6.
Cobalt oxides and hydroxides kilograms	160	--		
Copper:				
Oxides and hydroxides do	102	143	--	All from West Germany.
Sulfate	19	287	--	Belgium-Luxembourg 200; West Germany 85.
Metal including alloys, all forms	12,391	16,342	66	Belgium-Luxembourg 7,768; Italy 4,896; West Germany 1,393; France 1,250.
Gold metal including alloys, all forms troy ounces	66,616	77,933	--	France 70,506; United Kingdom 5,466; Switzerland 1,961.
Iron and steel:				
Ore and concentrate	(1)	62	62	
Metal:				
Scrap	12	106	6	Belgium-Luxembourg 100.
Pig iron, ferroalloys, similar materials	11,252	18,464	(1)	West Germany 14,196; Spain 1,797; Canada 1,450; France 464.
Steel, primary forms	r202,899	306,420	157	West Germany 193,786; Sweden 50,392; Belgium-Luxembourg 30,718; Netherlands 24,750.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	r610,184	533,291	295	Italy 167,969; Spain 126,675; Belgium-Luxembourg 75,914.
Universals, plates, sheets	r72,266	112,977	209	West Germany 51,576; Belgium-Luxembourg 23,719; France 13,724.
Hoop and strip	r2,324	21,633	18	West Germany 12,576; Belgium-Luxembourg 6,140.
Rails and accessories	r16,368	20,871	--	Austria 11,064; France 3,663; Belgium-Luxembourg 2,591; West Germany 1,869.
Wire	r35,397	50,115	34	Spain 14,952; Belgium-Luxembourg 10,668; Italy 10,076.
Tubes, pipes, fittings	r245,034	490,432	35,942	Japan 199,050; Belgium-Luxembourg 68,226; West Germany 59,855; France 51,023.
Castings and forgings, rough	r1,073	680	(1)	France 485; West Germany 110; Spain 46.
Lead:				
Ore and concentrate kilograms	--	88	--	All from West Germany.
Oxides	1,052	2,367	--	West Germany 1,211; France 509; United Kingdom 300; Netherlands 255.
Metal including alloys:				
Scrap	--	3	--	West Germany 2; Switzerland 1.
Unwrought	r5,074	9,706	--	Belgium-Luxembourg 5,772; West Germany 2,300.
Semimanufactures	r266	70	4	West Germany 20; Sweden 17; Belgium-Luxembourg 15.
Lithium oxide and hydroxide	(1)	30	--	Mainly from West Germany.
Magnesium metal including alloys, all forms	5	7	--	Belgium-Luxembourg 6.
Manganese oxides	2,232	316	--	West Germany 160; Belgium-Luxembourg 150.
Mercury 76-pound flasks	r8	61	1	West Germany 36; France 15; Belgium-Luxembourg 9.
Molybdenum oxides and hydroxides	--	66	--	Mainly from Italy.
Nickel:				
Oxides and hydroxides	16	(1)	--	All from Italy.
Metal including alloys, all forms	118	91	39	West Germany 21; France 17; Switzerland 7.
Platinum-group metals including alloys, all forms troy ounces	2,186	5,723	32	France 3,247; United Kingdom 1,190; West Germany 707; Switzerland 547.
Rare-earth metals:				
Oxides and other compounds kilograms	2,863	730	10	Italy 300; West Germany 260; France 100.
Metal including alloys, all forms	10	3	--	United Kingdom 1; Spain 1.
Silver metal including alloys, all forms troy ounces	358,545	259,392	NA	France 208,529; Switzerland 23,566.
Tin metal including alloys, all forms	63	152	(1)	Belgium-Luxembourg 85; Italy 28; Bolivia 20; Spain 6.
Titanium:				
Ore and concentrate	277	288	--	Australia 216; France 72.
Oxides	3,026	2,899	--	Mainly from West Germany.
Tungsten metal including alloys, all forms kilograms	807	486	202	United Kingdom 201; France 82.
Zinc:				
Ore and concentrate	20,000	27,976	--	Sweden 11,437; Canada 10,816; Peru 5,721.
Oxides	358	630	--	West Germany 358; Netherlands 100; France 79.
Metal including alloys, all forms	684	1,522	10	Belgium-Luxembourg 535; West Germany 450; France 431; Bulgaria 40.
Zirconium ore and concentrate	10	--		
Other:				
Oxides, hydroxides, peroxides	r460	1,123	--	Spain 1,100; West Germany 6.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Metals:				
Metalloids	100	63	--	Italy 39; West Germany 13; Switzerland 8.
Pyrophoric alloys	3	1	--	Mainly from China, mainland.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, natural corundum, etc	60,915	31,266	(1)	Italy 23,075; Greece 8,185.
Grinding and polishing wheels and stones	1,016	545	5	France 142; Switzerland 101; Italy 100.
Dust and powder of precious and semi-precious stones including diamond kilograms	--	32	--	Denmark 29; West Germany 2; France 1.
Artificial corundum	26	72	--	France 70; West Germany 2.
Asbestos	15,872	9,414	--	U.S.S.R. 3,058; Botswana 2,372; Australia 2,000; Canada 1,861.
Barite and witherite	67,388	98,985	--	Italy 66,130; Spain 23,961; Ireland 4,503.
Boron materials:				
Crude natural borates	65	4	--	Hong Kong 2; France 1.
Oxide and acid	236	219	6	Italy 188; Spain 14; France 4.
Cement thousand tons	2,190	1,794	13	Spain 740; Greece 419; France 258; U.S.S.R. 195.
Chalk	7,359	4,498	--	France 2,602; Spain 1,132; Italy 299.
Clays and clay products:				
Crude clays:				
Kaolin and bentonite	12,393	11,686	(1)	United Kingdom 8,106; West Germany 1,729; Spain 850; France 530.
Other	4,588	3,833	21	Spain 2,890; United Kingdom 487; Japan 180.
Products:				
Refractory including nonclay brick	45,301	32,919	28	U.S.S.R. 11,802; West Germany 6,480; Italy 4,801; Japan 3,089.
Nonrefractory	1,399	5,411	(1)	Spain 4,273; West Germany 471; Italy 437; France 180.
Cryolite and chiolite	--	3	--	All from France.
Diamond:				
Industrial thousand carats	525	675	--	West Germany 585; Zaire 90.
Gem, unworked do	1,900	5	--	All from France.
Diatomite and other infusorial earth	56	30	--	West Germany 20; France 10.
Feldspar, leucite, nepheline	2,585	3,091	--	Italy 1,851; West Germany 930; Japan 190; France 120.
Fertilizer materials:				
Crude: Phosphatic	(1)	4	--	West Germany 3.
Manufactured:				
Nitrogenous	87,454	72,167	--	Romania 37,476; Bulgaria 34,125.
Phosphatic	40,321	10,000	--	All from Tunisia.
Potassic	78,535	54,760	--	Italy 31,105; Spain 23,655.
Other, including mixed	21,523	(1)	--	All from France.
Ammonia	r61,447	15,552	3,962	United Kingdom 11,514; France 63.
Fluorspar	535	37	--	West Germany 25; France 12.
Graphite, natural	472	178	--	West Germany 136; Madagascar 41.
Gypsum and plasters	4,480	3,642	5	France 2,929; West Germany 548.
Iodine	(1)	1	--	Mainly from West Germany.
Lime	2,714	4,126	--	France 2,510; Spain 1,359.
Magnesite	422	435	--	Austria 360; West Germany 54; Switzerland 15.
Mica, worked including agglomerated splittings	10	31	(1)	West Germany 29.
Pigments, mineral:				
Natural, crude	649	--		
Iron oxides, processed	573	577	--	West Germany 486; France 50.
Precious and semiprecious stones excluding diamond, natural and synthetic thousand carats	140	6,275	--	West Germany 4,000; France 2,000; Austria 275.
Salt and brines	47	149	--	West Germany 124; France 25.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s:				
Caustic soda	r19,043	17,207	(1)	Italy 11,175; Spain 5,278.
Caustic potash	r160	4	--	France 3.
Soda ash	r7,043	20,685	3	Italy 13,481; France 5,021; Romania 930.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	45	70	(1)	Mainly from France.
Worked	37	39	--	West Germany 35.
Dolomite, chiefly refractory grade	3,143	2,040	--	Spain 1,435; West Germany 232; Italy 168.
Gravel and crushed rock	920	7,201	--	Italy 7,091; West Germany 47; Spain 29.
Quartz and quartzite	1,486	2,078	(1)	Italy 1,428; West Germany 473; France 170.
Sand, excluding metal-bearing	2,515	2,114	9	Belgium-Luxembourg 1,600; Netherlands 283; Switzerland 163.
Sulfur:				
Elemental:				
Other than colloidal	87,870	76,334	7,510	Canada 41,715; Poland 27,109.
Colloidal	19,238	8,000	--	All from Spain.
Sulfur dioxide	246	--		
Sulfuric acid	25	22	(1)	France 12; West Germany 9.
Talc, steatite, soapstone, pyrophyllite	5,068	1,835	--	West Germany 674; Spain 511; France 290; Italy 260.
Other:				
Crude:				
Vermiculite, perlite, chlorite	9	426	--	United Kingdom 425; France 1.
Other	38	75	(1)	Mainly from West Germany.
Oxides and hydroxides of magnesium, strontium, barium	18	65	--	West Germany 33; China, mainland 30.
Halogens	(1)	18	2	Switzerland 13.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	13	348	--	All from U.S.S.R.
Carbon black	2,960	2,080	29	Spain 844; United Kingdom 666; West Germany 498.
Coal, all grades including briquets	49,926	36,007	--	U.S.S.R. 30,530; West Germany 5,477.
Coke and semicoke	186,229	184,684	--	West Germany 86,472; U.S.S.R. 57,352; Italy 40,860.
Hydrogen, helium, rare gases	373	693	2	Italy 313; United Kingdom 185; West Germany 127; France 66.
Peat including briquets and litter _ kilograms	--	37	--	All from France.
Petroleum and refinery products:				
Crude _ thousand 42-gallon barrels	(1)	(1)	--	All from Spain.
Refinery products:				
Gasoline _ do	877	962	--	Italy 943; Netherlands 12.
Jet fuel and kerosine _ do	45	10	--	Belgium-Luxembourg 4; Italy 4.
Distillate fuel oil _ do	854	824	--	Mainly from Italy.
Residual fuel oil _ do	1,071	931	(1)	Do.
Lubricants _ do	274	540	1	United Kingdom 333; Italy 155; Belgium-Luxembourg 46.
Other:				
White spirit _ do	34	29	(1)	Mainly from Netherlands.
Liquefied petroleum gas _ do	1,526	1,426	(1)	Libya 672; Saudia Arabia 388; Venezuela 261.
Mineral jelly and wax _ do	61	76	--	Mainly from West Germany.
Asphalt and bitumen _ do	486	651	(1)	Spain 223; Italy 171; France 103.
Petroleum coke and flux _ do	(1)	1	--	Mainly from France.
Paraffin oil _ do	(1)	1	--	Mainly from Belgium-Luxembourg.
Unspecified _ do	15	5	--	Mainly from United Kingdom.
Total _ do	5,243	5,456		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,744	6,108	--	Mainly from France.

rRevised. NA Not available.
1Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Construction plans continued to be made for Algeria's first aluminum smelter located at M'Sala. Late in 1980, the Algerian Government and the U.S.S.R. were reported to be ready to build a 140,000-ton-per-year reduction plant.[4] A larger, 600,000-ton-per-year alumina project worth $500 million was proposed as a joint venture between Algeria, Jamaica, and Mexico.

Iron Ore.—The Ouenza Mine doubled the previous year's iron ore output to 2 million tons per year. Production was expected to increase commensurate with domestic demand for steel. Total output from the Ouenza Mines was expected to be exhausted by the El Hadjar steel complex in 2 years. Nearly 5 million tons of iron ore was expected to be required for steel production in 1985.

Feasibility studies and overall project design plans for the Gara Djebelet iron ore deposits, continued to be formulated by Tiajpromexport (U.S.S.R.) and Bechtel Inc. (United States). Production from the Gara Djebelet Mines were expected to significantly contribute to projected domestic iron and steel demands, however, development of the deposits were postponed during 1980.

Iron and Steel.—Expansion of the production line and capacities at the El Hadjar Steelworks continued throughout 1980. The major components of the enlarged cast-iron production facilities included 2 coking workshops with 65 furnaces in each, 2 iron ore agglomeration workshops, and 2 blast furnaces with capacities 400,000 tons per year and 1.4 million tons per year, respectively. The second set of coking works and blast furnaces were expected to be put into service before the second half of 1981. The flat-product process capacity expansions consisted of, Steelworks No. 1 with a capacity of 1.3 million tons per year, a hot-rolling mill of 1.2-million-ton-per-year capacity, and a cold-rolling mill expected to reach 700,000-ton-per-year capacity when completed.

Other improvements included raising spiral pipeworks capacity to 100,000 tons per year, seamless piping to 110,000 tons per year, and seamless pipeworks to 70,000 tons per year. Steelworks No. 2 at the end of 1980, had the capacity to produce 700,000 tons per year of billets used in long products and a 540,000-ton-per-year concrete rolling mill for round wires. A complex of general technical services was organized to coordinate the operations of the various production workshops. The complex utilized electricity and natural gas furnished by SONELGAZ. The Ben Azouz quarry in Skikda provided all the limestone required for the steelworks. Coke, which was previously imported, was expected to be increasingly replaced by the new cokeworks.

Negotiations were underway to construct an additional 2-million-ton-per-year direct-reduction steelwork at Jijel. Originally the Jijel plant was expected to supply semimanufactures to the proposed 900,000-ton-year rolling mill at Moulay Slissen. The mill negotiations were suspended in 1980, but were expected to resume during 1981. The engineering services contract for the Jijel plant was awarded to Tractionnel (Belgium), with assistance expected to be provided by Nippon Steel Corp. (Japan).

Other Metals.—Exploration for minerals in the Hoggar Mountains continued during 1980. Investigations were conducted on possible lead, zinc, tungsten, and uranium deposits. SONAREM selected Cotecna Engineering (Switzerland) as the main contractor to develop uranium mining at Tingaouine. The company was expected to conduct a topographical survey and design infrastructure for a mining town. A U.S. company, A.G. McKee, was contracted to supply a uranium ore processing plant. Tractionnel and Union Minière, two Belgium firms, conducted infrastructure assessments and were expected to supply power and telecommunications systems. The Hoggar uranium reserves, estimated at 25,000 tons, were projected to be capable of supplying 5,400 megawatts of electricity for a total of approximately 30 years. Roughly 1,200 tons of uranium concentrate was expected to be produced by 1984. The projected production level may be difficult to achieve when considering the lack of water and the overall remoteness of the area.

Table 4.—New and expanded cement facilities in Algeria in 1980

Plant name/location	Production capacity (million tons per year)	Expected startup date	Cost[1] (million dollars)	Contractor
Sétif/'Ain-Kebira	1	1978	NA	West German Consulting Group.
El Asnam	2	1979	NA	Kawasaki Heavy Industries Ltd. (Japan).
Saida	1	1979	NA	Do.
Beni Saf	1	1980	261	Creusot Loire Enterprise and Prospective Engineering (France).
Zahana II	1	1980	NA	Fives-Cail Babcock (France).
Tebessa	1.1	1981	243	Marubeni Corp. and Kawasaki Heavy Industries Ltd. (Japan).
Hamma Boziane	1	1982	NA	Creusot Loire Enterprise (France).
Sour El Ghozlane	1	1982	250	Smidth, and F.L. Smidth (France and Denmark).
Bouira	1	1983	NA	CBR Consulting Engineers (Belgium).

NA Not available.
[1]All projects were subject to fixed-price contracts.

NONMETALS

Cement.—Algeria's public construction corporation, Société Nationale des Matériaux de Construction continued to close the gap between domestic cement production and imports. Despite the raising of annual production to approximately 5.6 million tons by 1980, nearly 1.5 million tons per year of cement still had to be imported. Projects were underway to increase cement production capacity to 12.5 million tons per year. Numerous cement facilities were completed over the past few years and new cement projects were at various stages of completion by yearend 1980.

Fertilizer Materials.—SONATRACH's fertilizer expansion projects at Arzew, Annaba, and Tebassa continued to be constructed during 1980. The first two facilities were expected to raise existing production capacities of ammonia by 630,000 tons per year and urea by 660,000 tons per year. The new Tebassa fertilizer plant and Annaba's expanded facilities were expected to add 330,000 tons per year of phosphoric acid, 280,000 tons per year of triple superphosphate, and 1.1 million tons per year of sulphuric acid. The nitrogenous and phosphatic fertilizer units were expected to be brought online in two phases during 1981 and 1983. The second urea facility for Arzew was still in the planning stage by yearend 1980. Technical difficulties at the Arzew and Annaba plants resulted in output efficiencies of approximately 40%.

MINERAL FUELS

Natural Gas.—SONATRACH operated 109 gas wells and produced approximately 517 billion cubic feet of natural gas in 1980. Two gas treatment modules, two LPG extraction units, and three liquefaction units were also operating during the year. The three existing LNG units had a total annual capacity of 600 billion cubic feet and three larger units were under construction during 1980. The cumulative production of gas as of December 1980 was 3.3 trillion cubic feet, for a level of proven recoverable reserves estimated at over 100 trillion cubic feet.

Natural gas comprised 29% of Algeria's total energy consumption in 1969, and a decade later, consumption nearly doubled to 54%. During the same period, total domestic consumption of energy quadrupled to an equivalent of 108 million barrels of oil. The continuing trend of increasing natural gas production and replacing oil by natural gas to meet domestic demand was expected. Applications of natural gas were expected to be broadened from mostly industrial projects to residential use.

Numerous long-term natural gas supply contracts were signed over the past few years, and renewals were negotiated during 1980. High crude oil prices stimulated demand in the LNG market. Algeria subsequently entered into price negotiations that would nearly double the rates accepted in previous agreements. SONATRACH attempted to raise the export price of LNG to a parity level with crude oil f.o.b. Arzew; The price was to be raised to $6.11 per thousand cubic feet or million British thermal units (Btu). When considering transportation and regasification costs, the proposed U.S. cost for Algerian natural gas would be equivalent to nearly $8 per thousand cubic feet. Due to a failure to reach a compromised natural gas price, LNG shipments to the United States through the El Paso contract were halted in April 1980. The El Paso contract comprised 1% to 1.5% of the total U.S. supplies during 1980.

Table 5.—Exploration agreements in Algeria in 1980[1]

Company	Foreign country	Area (square kilometers)	Location	Exploration expenditure[2] (million dollars)	Production split
Compagnie Francaise des Petroles (CFP)	France	4,300	Beriane/Hassi R'Mel.	52	60/40
Standard Oil Co. of Ohio (Sohio)	United States	3,654	Near Tunisian border.	NA	60/40
Braspetro	Brazil	2,800	Zelfana	32	62/38
German Group (Veba, Saarbergwerke, Union Rheinsche, Wintershall).	West Germany	11,000	Guelta, Meksem El Abiad, Tamlet, El Medressa, Oued Takouart.	165	60/40
Compagnie Francaise des Petroles (CFP) and BP Gelsenberg Co.	France, West Germany.	5,000	Erg Oriental	NA	NA
Amoco (subsidiary of Standard Oil Co. of Indiana).	United States	5,000	Bethouadiane	40	65/35
Sun Oil Co	do	9,000	Hassi Matmat	40	58/42
Compagnie Francaise des Petroles (CFP) and BP Gelsenberg Co.	France, West Germany.	7,185	Sif Fatima and El Merk, Erg Oriental.	78 60	65/35
Standard Oil Co. of Ohio (Sohio)	United States	3,642	Near El Borma	NA	NA
Azienda Generale Italiani Petroli S.p.A. (Agip) /Ente Nazionale Idrocarburi.	France, Italy.	9,100	Erg Oriental	NA	NA
Elf/Aquitaine	France	9,000	Southern Algeria (along edge of Sahara Desert).	NA	60/40

NA Not available.
[1]Mid East Economic Survey. V. 23, No. 52, Oct. 13, 1980, p. 9.
[2]Foreign company share of expenditures.

Construction on the trans-Mediterranean pipeline continued during 1980, and negotiations were taking place between SONATRACH and Italy to expand the pipeline's annual capacity from the originally designed 423 billion cubic feet to 637 billion cubic feet. The initial agreement called for a total of 10.4 trillion cubic feet over a 25-year period, with deliveries of 438 billion cubic feet per year beginning late in 1981. Algeria's projected cost was $702 million for a pipeline 550 kilometers long, running from Algeria's Hassi R'Mel fields to Oued Safsaf on the Tunisian border. In addition, Algeria would pay $266 million or one-half the cost for the 158-kilometer-long underwater section from Cap-Bon, Tunisia, to Sicily. The expansion scheme would require a fourth 50-centimeter underwater line, and a second Italy-Algeria gas pipeline, which would connect with an existing network in the Alps.

Whether or not the pipeline is put into operation will depend on adjusted gas price agreements. The large investments required for increased gas exports hinged on assured price development and depended on the Algerian Government maintaining control over supplies and exploitation of the wells.

Petroleum.—Algeria had 1,015 oil wells, 4 refineries, 2 petrochemical complexes, and several plastic processing units operating in 1980. Proven crude oil reserves were estimated at 8.2 billion barrels and refining capacity increased to approximately 150 thousand barrels per day. The oil equivalent of recoverable gas reserves were 2.5 times the proven reserves of crude. Cumulative production at the start of 1979 was 5.4 billion barrels of crude oil and 153 million barrels of condensate.

Oil consumption during 1980 was estimated at 123 million barrels and represented 21% of the 575 million barrels produced.[5] Domestic demand for crude oil and refinery products were projected to comprise 30% of the total production by 1990 and 77% by 2000. The increasing percentages primarily reflect a planned production cutback over the decade.

Exploration efforts were ambitious and a $3 per barrel surcharge applied to oil exports in the first half of 1980 financed the drilling of approximately 20 to 30 wells. Over the past decade, little was discovered in Algeria's huge sedimentary basins, measuring 1.5 million square kilometers. Agreements signed with foreign companies have generally been in difficult access and high-risk areas, resulting in less than 1/16 exploration of the sedimentary basin. In 1980, there were 11 partnership agreements with 15 foreign companies. Greater incentives were expected to be offered to foreign investors through the granting of larger exploration tracts and improved contract terms.

During the first half of 1980, eight explo-

ration deals were concluded. The agreements obliged SONATRACH to repay its share of the expenditures if commercial production was to be established. SONATRACH assumed total control of operations during the development-production phase, and the foreign partner's share of production was subject to Algeria's statutory tax and royalty payments. Nearly 50,000 square kilometers were expected to be explored under the new contracts, at an estimated total cost of nearly $700 million.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Algerian dinars (DA) to U.S. dollars at the rate of DA3.846=US$1.00 for 1980.

[3]U.S. Embassy, Algiers. State Department Airgram A-02. Economic Trends Report. Apr. 26, 1981, 9 pp.

[4]America Metal Market (New York). Expansion Plans in Third World Primary Aluminum Production. V. 88, No. 219, Nov. 11, 1980, p. 3A.

[5]Al-Sha'b (Algiers). Ministry of Planning's Energy Report Before Economic and Social Committee; Review of the Fuel Consumption and Production Situation and Prospects. Nov. 17, 1980, p. 3.

The Mineral Industry of Angola

By George A. Morgan[1]

In 1980, despite continued unstable conditions in part of the country because of the ongoing civil war, the mineral industry showed some signs of progress. Exports of crude oil gained in value by 138% to $2 billion,[2] due in large part to oil price increases. Angola became the fifth leading producer of oil in Africa. The major portion of Government revenue was from oil exports, which also provided a favorable balance of trade.[3]

Revenue from the sale of oil was being channeled into infrastructure development. Port congestion was experienced in Luanda because of the large volume of imports. Vessels were delayed in offloading 100,000 tons of merchandise, and 64,000 tons was confined to warehouses. Most of the material was new machinery and parts.

Changes in the 1979 investment code permitted the participation of foreign interests, particularly in oil exploration and exploitation. Private firms were also permitted to qualify as importers in 1981 provided that application for such was received by March 1981. Previously only state-owned enterprises were allowed import rights.

PRODUCTION AND TRADE

Production data for the mineral industry continued to be generally unavailable with output of most commodities estimated on the basis of limited information. Diamond output continued to increase, although investment requirements were rising because of declining ore grade. The Government concentrated its efforts on increasing the return from the energy sector and to that end granted exploration and production sharing rights to a number of companies, mainly for offshore areas. Reestablishment of iron ore production was proposed, apparently from the Cassinga area in the south of the country. Angola, Zaire, and Zambia, although in agreement on measures to renovate the Benguela railroad, continued to be hampered by the reluctance of major mining concerns to send exports over the line because of security risks. Iron ore development at Cassinga, located south of the Benguela line, would presumably also be subject to similar security problems.

The supply of electricity to Huambo, Benguela, and Bie was interrupted for an extended period, ostensibly owing to a shortage of rainfall. However, the backup powerplant near Biapio was also out of service because of damage from unspecified causes.

Although official trade data continued to be unavailable, Western nations accounted for most of the value of trade. Commercial trade with France alone amounted to about $89 million in 1980, and contracts totaling over $220 million were also signed between the two countries.

Table 1.—Angola: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Iron and steel: Crude steel[e]	5,000	5,000	10,000	10,000	10,000
NONMETALS					
Cement, hydraulic thousand tons	300	300	400	[e]400	400
Clays: Kaolin	--	500	--	--	--
Diamond:					
Gem thousand carats	255	265	525	630	1,125
Industrial do.	85	88	175	210	375
Total do.	340	353	700	840	[3]1,500
Gypsum[e]	20,000	20,000	25,000	25,000	25,000
Salt[e]	50,000	50,000	50,000	50,000	50,000
Talc[e]	50	--	--	--	--
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural[e]	20,000	25,000	25,000	25,000	25,000
Gas, natural:[e]					
Gross million cubic feet	22,000	42,400	46,500	48,600	58,000
Marketable do.	2,000	2,500	2,500	2,500	2,500
Petroleum:					
Crude thousand 42-gallon barrels	36,700	62,437	47,450	49,640	60,000
Refinery products:					
Gasoline do.	429	526	510	[e]500	NA
Jet fuel do.	446	441	480	[e]450	NA
Kerosine do.	136	163	160	[e]160	NA
Distillate fuel oil do.	949	1,469	1,567	[e]1,500	NA
Residual fuel oil do.	2,924	3,725	3,796	[e]3,700	NA
Other do.	120	143	189	[e]150	NA
Refinery fuel and losses do.	184	229	368	[e]300	NA
Total do.	5,188	6,696	7,070	[e]6,760	NA

[e]Estimated. [p]Preliminary. NA Not available.

[1]Table includes data available through Sept. 29, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and broken stone) presumably is produced for local consumption, but information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

COMMODITY REVIEW

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Iron Ore.—The creation of a national iron company was planned following decrees in late 1979. All assets and rights of Companhia Mineira do Lobito, S.A.R.L., which owned and operated the Cassinga Mine, and Companhia do Manganes de Angola (CMA), which owned and operated iron mines at Cassala, were nationalized. Austromineral, a subsidiary of Voest-Alpine A.G., was to conclude studies regarding the exploration of additional high-grade iron ore reserves at Cassinga as well as at Cassala. Initial rehabilitation of Cassinga was planned for 1981 and would involve extraction and treatment of 2 million tons of crude ore. Iron ore reserves at Cassinga were estimated at 100 million tons of eluvial hematite grading 62% to 64% iron and 2 billion tons of itabirite-type ore. The Cassala-Quitungo magnetite deposits contained 92 million tons of ore grading 32% iron. Earlier plans for developing the Cassala-Quitungo deposits involved the production of 4 million tons of ore to yield about 1.8 million tons of concentrate grading 67.5% iron for pelletization.

Manganese.—Little information has been available on the manganese industry in Angola. Reported production from thin, tabular, steeply dipping surface ore bodies in the vicinity of Salazar and Nova Lisboa peaked in the early 1950's at about 70,000 tons per year. Output was adversely affected by low manganese prices and difficulties in locating markets because of high silica and sulfur content. Most production was by CMA from the Salazar area, where about 48 million tons grading 44% to 56% manganese existed. Output was estimated to have been nonexistent since 1973. In 1980, the Government nationalized CMA because of the company's poor financial condition. Al-

though there have been some reports of manganese ore finds, nothing has been realized in terms of development.

NONMETALS

Cement.—In 1980, only about 56% of the 720,000 tons per year cement production capacity was utilized. Old equipment, lack of spare parts, and limited financial resources were cited for the poor showing. Government planning called for production of another 650,000 tons by yearend 1982. The increased output was to be made possible by a $36 million loan agreement with Danish interests. Refurbishing the Luanda cement plant as well as improving the ship loading facilities were part of the agreement. Because of limited local demand, exports were expected to increase to about 336,000 tons from the current level of several thousand tons per year. Plant capacity would also increase to 1.26 million tons per year by the addition of a fourth kiln. No time frame was reported for installation of the kiln.

Diamond.—Production of diamonds increased but continued to be well below planned output levels and was still well below the 2.4 million carats achieved in 1971. A new washery costing $1.5 million was inaugurated in the Lucapa mining areas of Luanda Norte Province. The new washery will allow a production increase of about 14,000 carats from the Camagico Mines.

Nearly all diamond mining was by mechanized methods except in the Audrada area. About 2.8 million cubic meters of gravel were treated in 1979 compared with a planned 3.7 million cubic meters. Actual output in 1979 was well below the planned 1.2 million carats. Failure to meet planned production levels was attributed to a shortage of qualified personnel and a lack of accessories and parts for washeries and machinery. Increased financial commitments were required to expand diamond output because of declining ore grade. Additional expenditures for equipment and machinery were required both for continued exploration and for additional washeries to treat larger amounts of low-grade material.

Phosphate Rock.—The indentification of potentially exploitable phosphate rock deposits in Angola was recorded as early as 1949, and the existence of coastal phosphate formations was known much earlier. Phosphate resources were located in several areas including the Calinda area, at Quindonacache, near Luanda, and at the mouth of the Cunene River. Several exploration concessions were granted and plans actually made for exploitation of the Cabinda phosphates by Ammoniaco Portuguese. However, no production has occurred in Angola. In 1980, the Government formed the Phosphate Extraction Co. (Fosfang) to mine phosphate at Quindonacache in Zaire district. Bulgareomina of Bulgaria was contracted to mine the deposits totaling 200 million tons. Initial output of 30 tons per day was to commence June 1981 with a total employment of 500 people.[4]

MINERAL FUELS

Petroleum.—The Government placed heavy emphasis on its petroleum sector, which was a significant source of foreign exchange. Production for 1981 was expected to increase about 8% from a level of 164,000 barrels per day in 1980. Direct Government investment in the industry was estimated at $150 million. About two-thirds of the total output of crude oil was from Cabinda by Gulf Oil Co. and Sociedade Angolane de Combustiveis de Angola.

A number of international oil firms were interested in exploration and production in Angola. Several firms were negotiating for exploration blocks offshore central and southern Angola.

Texaco Angola Prospeccão e Pruducas (Teipac) S.A.R.L. was developing the Essungo Field. A production platform with a capacity to handle 20,000 barrels per day along with 23 miles of marine pipeline was under construction. Construction was to be completed by mid-1981, with output planned at 17,000 barrels per day by yearend 1981. The Government requested that uses be found for associated gas production rather than the current practice of flaring.

Petrobas of Brazil signed a contract with Sonangol for oil exploration offshore Angola. Crude oil sales to Brazil were to be increased 25%. Exports to Brazil in 1980 were 2.5 million barrels of crude oil.

The Luanda crude oil refinery achieved a record throughput of 1,224,000 tons in 1980, up 8.5% from the previous year's throughput.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary values have been estimated to be convertible from Angolan kwanza to U.S. dollars at the rate of kwanza1 = US$0.032 for 1980.

[3]Mining Annual Review - 1981 (London). Angola. P. 489.

[4]Mining Journal (London). Angolan Phosphate Mining. V. 296, No. 7595, Mar. 13, 1981, p. 197.

The Mineral Industry of Argentina

By Pablo Velasco[1]

Over the last 25 years, Argentina's economic development has fluctuated between periods of rapid growth and stagnation. In 1980, Argentina's gross domestic product (GDP) declined between 1.0% and 1.5% to $127 billion[2] at current prices. The inflation rate declined for the first time since 1974, but still remained high at over 87%. Agricultural production in 1980 declined 3%, while manufacturing output fell 4%. In contrast, mining production was up 2%, services 15%, and construction 4%. The aluminum industry and oil refineries registered high production. Capacity utilization in the entire industrial sector averaged only 50%. The steel industry output declined 11% in 1980, compared with the 1979 output. The mineral industry of Argentina, with the exception of minerals fuels (petroleum, natural gas, and coal), represented less than 1% of the GDP in 1980. Exports of industrial minerals, including products for the construction industry, also have increased in volume and value. Aluminum exports rose by 40%, or 67,000 metric tons, compared with 1979 exports.

The Argentine Government is considering building a second aluminum smelter at Río Gallegos in Santa Cruz Province, taking advantage of the abundant energy resources (natural gas, coal, and later hydroelectric power). The cost of the project will be approximately $800 million, and output is predicted to be 100% for export. The Comisíon Nacional de Energía Atómica (CNEA) reported that uranium oxide reserves increased 6% in 1980 to 28,000 metric tons. Several contracts have been signed to mine several uranium deposits in Córdoba, Mendoza, and most recently in San Luis. CNEA's $10 billion 20-year nuclear power program calls for the installation of six nuclear power units by the year 2000, which will provide 3,400 megawatts of nuclear generating capacity. Argentina intends to sign an arrangement with Brazil for offering nuclear systems to the rest of Latin America.

Argentina has abundant natural gas reserves, which could be exploited for another 50 years. A good start in providing the greatly expanded pipeline network needed to bring this gas to consumption centers was made in 1980. Additional pipelines will eventually be constructed to exploit deposits in Salta and Jujuy, making it possible to export natural gas to Paraguay, Uruguay, and Brazil. Argentina continued as the third largest producer of crude oil in Latin America with new discoveries of oil offshore in the southern sea basin.

Yacimientos Petrolíferos Fiscales (YPF) and Gas del Estado were active in exploration and expansion of production of petroleum and natural gas. Argentina is already 95% self-sufficient in oil.

Total electric power generated in Argentina in 1980 increased 8.1% to 35.8 million megawatt-hours. The breakdown in electric power sources in 1980 and 1979 follows, by percent:

	1979	1980
Thermal energy	59.8	51.2
Hydroelectric	32.0	42.2
Nuclear	8.2	6.6
Total	100.0	100.0

Nuclear power capacity at this stage remained unchanged with only the Atucha I nuclear reactor in operation. The Embalse and Atucha II nuclear powerplants were still under construction.

Government Policies and Programs.—The Mining Promotion Law No. 22,095, issued in October 1979, aims at reaching the full and sustained development of mining by enlarging tax benefits contained in former laws, for both promotion in general and special promotion. The law contemplates benefits for both national and foreign investments. Special benefits provided by the law to mining companies include reduction of the profits tax, the tax on capital, and the tax on net worth, for not more than 51 years from the start of production, on a scale ranging from 100% to 10%; exemption of taxes and duties on imports of equipment, accessories, and spares necessary for the execution of the project; and loans from the Mining Promotion Fund for research and exploration. Up to 80% of the amount of the loan may be written off should the exploration prove to be unsuccessful. These loans are to be granted preferentially to small- and medium-size mining firms with Argentine ownerships. Certain benefits are also provided for investors who invest in mining operations. The reforms to the Mining Code, which entered into force on November 29, 1980, have different purposes. One refers to an adjustment to the present system which grants the property rights of the mines to the discoverer prior to exploration. The reformed mining code also updates the amount of capital to be invested as a condition for the concession. Larger concessions to explore will be granted. Two chapters are added to the Mining Code empowering the national state, with the prior agreement of the respective Provinces, to call for international tenders for the exploration and exploitation of large mining areas or deposits discovered by the state. The Argentine Mining Code has adopted the system of concession for royalties, which was instituted in America by the Spanish colonizers in the 18th century. Under the reforms to the Mining Code, the following metals are transferred to the first from the second category: Molybdenum, lithium, potassium, sulfur, and borates. Asbestos, bentonite, and zeolite are transferred from the first to the second category. The maximum exploration area is increased from 2,000 to 10,000 hectares, and the maximum duration of permits is extended from 300 to 1,100 days. Those exceeding 300 days will suffer area reductions. The possession of deposits in the first category is increased from 6 to 100 hectares. The investment of a minimum fixed capital as a condition for the concession is left to the criterion of the concessionaire or owner of the mine, instead of being fixed by mining authorities. In any case, the investment may not be less than 500 times the annual royalty corresponding to the mine according to its category and the number of units. Should the mine have been completely inactive for more than 4 years, the authorities may demand the submittal of a plan for reactivating the mine under penalty of losing the concession. The concessionaire will have 5 years to perform the different stages of the project.

Now that the revised code has become operative, no time is being lost in seeking foreign expertise, technology, and equipment to explore and develop Argentina's mineral resources. The Department for Promotion of Mining of the Mining Secretariat has defined a number of metal-mineral deposits as being of special interest, and these are being offered to national as well as international groups. (More details on this matter are given under Commodity Review—Copper.)

PRODUCTION

Output from the mining industry in Argentina during 1980 was at the level of the past several years. The country produced enough nonmetallic minerals to meet domestic demand but continued to import large tonnages of iron, manganese, bauxite, chromium, and coal.

The modest amount of metallic minerals produced included copper, lead, zinc, iron ore, manganese, uranium, gold, and silver. The steel industry output declined 11% in 1980, and was strongly affected by the high rate of exchange of the peso against the U.S. dollar. A number of small steelmakers, notably Aceros Ohler S.A., have gone out of business. Aluminum production from the smelter at Puerto Madryn increased 9.1% to 138,000 metric tons in 1980. Argentina ranks third in production of cement in Latin America, after Brazil and Mexico. Production of cement in Argentina in 1980 was the largest in the past 10 years. Installed capacity for the entire industry in 1980 was 9.8 million metric tons per year, and production reached 7.0 million metric tons, a 7% increase over that of 1979. Yacimientos Carboníferos Fiscales, the Government-owned coal company, re-

ported that production of coal from Río Turbio declined by 46% owing to lack of local demand, mainly from the steel industry, and to the increase in imports from the United States and Poland. Argentina continued as the third largest producer of crude oil and natural gas in Latin America with new discoveries of oil offshore near the Strait of Magellan and at the Neuquén Gasfields.

Table 1.—Argentina: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal:					
Primary	43,122	49,875	53,098	118,421	[3]137,500
Secondary[e]	9,500	6,500	8,000	9,000	9,000
Antimony, mine output, metal content kilograms	2,200	--	--	--	--
Beryllium: Beryl concentrate:					
Gross weight	112	[r]165	22	12	[3]15
BeO content	13	18	2	1	2
Bismuth kilograms	--	--	300	--	--
Chromium: Chromite, gross weight	--	--	--	165	169
Columbium-tantalum concentrates, gross weight:					
Columbite kilograms	107	614	--	1,200	[3]1,500
Tantalite do	175	170			
Copper:					
Mine output, metal content	265	169	319	187	191
Mine, smelter[e]	60	70	NA	NA	NA
Gold, mine output, metal content troy ounces	5,804	5,509	5,600	10,140	[3]11,108
Iron and steel:					
Iron ore and concentrate, gross weight thousand tons	506	1,030	909	611	[3]710
Metal:					
Pig iron and sponge iron do	1,306	1,380	1,819	1,942	[3]1,806
Ferroalloys, electric furnace:					
Ferromanganese	23,841	28,780	25,115	34,373	31,600
Silicomanganese	6,300	6,168	10,281	15,389	14,200
Ferrosilicon	17,052	15,313	10,343	13,915	12,800
Other	533	823	448	2,413	2,200
Total	47,726	51,084	46,187	66,090	60,800
Crude steel thousand tons	2,422	2,676	2,780	3,197	2,808
Semimanufactures[4] do	2,004	2,356	2,205	2,593	2,036
Lead:					
Mine output, metal content	33,004	33,305	30,253	33,973	[3]34,803
Metal:					
Smelter, primary[e]	[r]40,000	[r]38,000	[r]30,000	[r]27,600	21,500
Refined:					
Primary	40,000	38,000	30,000	27,600	21,500
Secondary	10,000	7,000	4,000	6,000	6,000
Total	50,000	45,000	34,000	33,600	27,500
Manganese ore and concentrate, gross weight	53,086	82,385	18,497	10,190	[3]9,700
Silver, mine output, metal content thousand troy ounces	2,250	2,451	2,040	2,193	2,200
Tin:					
Mine output, metal content	358	537	362	479	[3]582
Metal, smelter[e]	120	120	120	120	120
Tungsten, mine output, metal content	62	70	97	59	[3]72
Uranium, mine output, U_3O_8 content kilograms	205,437	217,898	168,832	196,176	[3]210,877
Zinc:					
Mine output, metal content	40,589	39,155	36,585	37,146	[3]33,799
Mine, smelter, primary	35,200	29,000	23,900	36,700	25,400
NONMETALS					
Abrasives: Garnet	--	600	21	3	4
Asbestos	889	686	1,069	1,371	[3]1,673
Barite	40,546	30,571	45,685	54,928	[3]58,005
Boron materials, crude	80,851	83,051	127,187	132,655	[3]138,123
Cement, hydraulic thousand tons	5,712	5,829	6,153	6,350	[3]7,058
Clays:					
Ball clay (plastic clay), n.e.s do	1,465	1,812	2,441	2,198	[3]2,320
Bentonite	132,313	114,836	106,957	157,382	[3]174,190
Foundry earth	211	([5])	--	41,082	[3]42,900
Fuller's earth (decolorizing clay)	3,133	4,129	3,482	5,445	[3]7,408
Kaolin	83,726	74,284	45,940	132,107	[3]139,200
Laterite (aluminous)	33,324	59,363	43,410	68,580	[3]76,970
Refractory	119,233	117,299	88,030	132,399	[3]147,188

See footnotes at end of table.

Table 1.—Argentina: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]		1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued						
Clays—Continued						
Other[6]		557,879	565,066	435,481	577,226	[3]624,474
Diatomite		13,850	12,337	7,227	7,321	[3]7,450
Feldspar		68,224	42,921	41,824	33,850	[3]36,908
Fluorspar		40,077	43,792	26,746	38,076	[3]41,852
Graphite		145	85	8	10	[3]12
Gypsum, crude		507,125	[r]546,968	611,158	587,432	[3]595,342
Lithium, spodumene, and amblygonite, gross weight		675	412	803	106	[3]150
Mica:						
Sheet		329	302	356	360	[3]990
Waste and scrap		2,291	1,840	2,276	1,140	[3]1,519
Nitrogen: N content of ammonia		37,600	42,000	47,200	49,200	46,200
Phosphate:						
Guano[e]		1,000	1,000	1,000	1,000	1,000
Thomas slag		1,693	NA	NA	NA	NA
Pigments, mineral, natural: Ocher		174	209	484	874	[3]1,004
Precious and semiprecious stones: Amethyst	kilograms	500	--	307	8,000	[3]10,000
Pumice and related volcanic materials		57,593	64,961	21,544	46,324	[3]54,584
Salt:						
Rock	thousand tons	1	[r]2	1	1	[3]1
Solar	do	660	1,146	699	619	[3]626
Total	do	661	[r]1,148	700	620	[3]627
Sand and gravel:						
Sand:						
Construction	do	14,893	16,178	14,773	15,348	[3]16,073
Ferruginous-titaniferous	do	280	1,833	307	410	[3]443
Silica sand (glass sand)	do	269	284	313	329	[3]335
Gravel	do	5,990	9,214	11,320	11,796	[3]12,455
Stone:						
Alabaster		--	--	50	--	--
Basalt	thousand tons	2,517	3,075	3,549	3,277	[3]2,307
Calcareous:						
Calcite, nonoptical		12,418	11,153	8,887	12,376	[3]13,539
Calcium carbonate (chalk)		58,109	52,997	7,419	13,174	[3]15,092
Dolomite		245,261	225,792	184,800	289,940	[3]324,986
Limestone	thousand tons	13,608	14,081	15,956	15,238	[3]15,491
Marble:						
Aragonite, broken		6,408	7,701	12,444	10,902	[3]11,200
Onyx, in blocks and broken		31,009	24,364	22,149	22,919	[3]24,196
Travertine, in blocks and broken		13,308	9,367	6,020	13,239	[3]15,909
Unspecified, in blocks and broken		69,209	61,166	60,271	108,857	[3]118,491
Flagstone		84,472	73,505	67,258	113,182	[3]128,490
Granite:						
In blocks		24,699	25,944	28,991	38,646	[3]41,864
Other dimension		8,250	--	--	--	--
Crushed	thousand tons	4,343	4,932	5,588	7,310	[3]7,908
Quartz, crushed		116,410	103,438	81,794	96,393	[3]101,259
Quartzite, crushed	thousand tons	1,269	1,327	1,903	1,594	[3]1,697
Rhodochrosite		11	47	42	73	[3]89
Sandstone		47,994	129	67	89,388	[3]97,065
Serpentine, crushed		55,748	27,449	32,359	32,376	30,000
Shell marl		605,193	428,908	671,427	663,472	[3]666,123
Tuff, tufa	thousand tons	2,006	1,971	1,707	2,646	[3]2,959
Strontium minerals: Celestite		2,054	839	1,195	122	[3]190
Sulfates, natural:						
Aluminum (alum)		24,800	29,421	44,425	48,454	[3]49,797
Iron (melanterite)		--	10	--	10	[3]12
Magnesium (epsomite)		12,412	5,487	7,801	11,909	[3]13,278
Potassium (kalinite)		--	--	250	300	[3]350
Sodium (mirabilite)		35,489	36,022	40,690	36,458	[3]37,868
Sulfur:						
Native, from caliche		20,000	[r]26,953	17,771	--	--
Byproduct, all sources[e]		19,000	20,000	20,000	20,000	14,000
Total		39,000	[r]46,953	37,771	20,000	14,000
Talc and related materials:						
Pyrophyllite		9,132	10,947	4,731	9,886	[3]11,605
Steatite		840	454	964	882	[3]910
Talc		44,185	43,306	41,117	24,059	[3]46,803
Total		54,157	[r]54,707	46,812	34,827	[3]59,318

See footnotes at end of table.

Table 1.—Argentina: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Vermiculite	4,098	4,825	4,426	5,877	[3]6,361
Water, mineral-containing	57,352	71,629	73,271	97,489	[3]121,707
Zeolite	23	15	12	25	[3]18
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	818	6,339	5,880	873	[3]960
Carbon black[e]	30,000	30,000	NA	NA	NA
Coal, bituminous thousand tons	615	533	434	727	389
Coke, all types, including breeze do	738	727	686	650	700
Gas, natural:					
Gross million cubic feet	389,584	411,867	406,265	452,570	430,000
Marketed do	272,284	274,992	259,678	283,560	270,000
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	447	72	24	NA	NA
Butane do	1,784	1,209	1,630	[e]1,500	1,400
Propane do	1,485	985	1,260	[e]1,200	1,200
Total do	3,716	[r]2,266	2,914	NA	NA
Peat, agricultural	9,532	6,207	4,447	3,516	4,200
Petroleum:					
Crude thousand 42-gallon barrels	145,561	157,248	165,138	172,272	184,000
Refinery products:					
Gasoline do	34,071	35,916	38,948	40,538	42,000
Kerosine do	6,178	5,872	5,107	4,190	5,000
Jet fuel do	3,784	4,054	4,506	4,809	5,000
Distillate fuel oil do	42,849	46,189	49,079	49,124	49,000
Residual fuel oil do	53,199	58,234	56,640	58,381	60,000
Lubricants do	1,615	1,986	1,791	2,106	2,400
Other do	10,080	16,789	8,482	8,500	8,500
Refinery fuel and losses do	13,882	7,808	8,597	14,591	12,000
Total do	165,658	176,848	173,150	182,239	183,900

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 26, 1981.

[2]In addition to the commodities listed, cadmium, lime, and perlite are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure. It should be noted that although most of these figures are officially reported, they are of a preliminary nature, subject to substantial revision.

[4]Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.

[5]Revised to none.

[6]Includes plastic, semiplastic, and/or ferruginous clays used totally in the manufacture of portland cement.

TRADE

For the first time since the present military government took power, Argentina's trade surplus disappeared, giving way to a deficit estimated at approximately $2.4 billion. This deficit was caused by the rapid growth of imports stemming from the programed reduction of tariffs and the stagnation of exports caused by the maintenance of an overvalued peso consistently lagging behind the domestic inflation rate. Total export value rose 3% from $7.8 billion in 1979 to $8.06 billion in 1980, while the total import value rose from $6.7 billion to $10.4 billion, a 55% increase. Higher international prices were the main factor accounting for the rise in export value. According to statistics published by the Secretaría de Estado de Minería and the Secretaría de Estado de Energía, exports of minerals, mineral products, and metals in 1980 earned a record high of $71.2 million, an increase of 104% compared with 1979 values.

The volume of mineral exports increased 6.1% to 114,200 metric tons. Exports of metallic minerals in 1980 increased to 55,000 metric tons, or 102%; the value of these exports increased to $37.2 million, or 164%. Exports of minerals were mainly concentrates of lead, zinc, tin, and silver. Exports of aluminum rose 40% to 67,000 metric tons. Exports of nonmetallic minerals declined 70%. Exports of petroleum products and residual coal in 1980 were valued at $266 million, a substantial increase compared with $51 million in 1979.

Petroleum imports during 1980 increased 26% to 16 million barrels. Imports of petroleum products, natural gas, liquefied gas,

and mineral coal in 1980 were valued at $1.06 billion 5.2% less than in 1979.

YPF, the State oil company, purchased 60% of Argentina's imported oil in 1980 from Saudi Arabia and Iraq. The remainder was imported by private firms and from other sources. Gas imports from Bolivia increased 12% to 73.6 billion cubic feet in 1980. Argentina's main fuel import from the United States in 1980 was bituminous coal, valued at $26 million.

Table 2.—Argentina: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide (alumina) and hydroxide kilograms	42	NA	NA	NA.
Metal including alloys, all forms	867	9,180	1,062	Republic of Korea 4,001; France 2,000; Brazil 475.
Beryllium: Beryl ore and concentrate	163	113	105	United Kingdom 8.
Chromium oxides and hydroxides kilograms	6	NA	NA	NA.
Copper metal including alloys, all forms	222	86	NA	Brazil 23.
Iron and steel metal:				
Pig iron, ferroalloys, similar materials	2,051	1,614	301	Japan 998; Netherlands 80; Belgium-Luxembourg 15.
Steel, primary forms	1	181,104	NA	Venezuela 129,681; Philippines 12,992; Colombia 12,969.
Semimanufactures:				
Bars, rods, angles, shapes, sections	86,044	197,861	74,697	Netherlands 47,582; Bolivia 14,349; Paraguay 12,897.
Universals, plates, sheets	114,093	245,042	79,276	Brazil 59,058; West Germany 46,065; Belgium-Luxembourg 24,128.
Hoop and strip	901	539	NA	NA.
Rails and accessories	4	2,317	--	Paraguay 2,127.
Wire	1,338	2,406	--	Bolivia 1,124; Paraguay 882; Uruguay 389.
Tubes, pipes, fittings	58,137	147,348	47,879	China, mainland 21,852; U.S.S.R. 12,273; Algeria 10,312.
Castings and forgings, rough	410	NA	NA	NA.
Lead:				
Ore and concentrate	NA	10,056	352	Brazil 9,446; Belgium-Luxembourg 258.
Oxides	32	NA	NA	NA.
Ash and residue	--	508	--	All to West Germany.
Metal including alloys, all forms	29	1,150	42	Uruguay 643; Japan 400.
Silver metal including alloys, unwrought or partly wrought troy ounces	r3,665	144,710	144,678	Uruguay 32.
Tin:				
Ore and concentrate[1]	NA	2,846	--	All to United Kingdom.
Metal including alloys, all forms	5	6	--	All to Uruguay.
Uranium ore and concentrate	--	48	--	All to United Kingdom.
Zinc:				
Oxides	(2)	215	NA	NA.
Metal including alloys, all forms	277	6,728	--	Brazil 5,491; Netherlands 500; Uruguay 487; Honduras 250.
Other:				
Ash and residue containing nonferrous metals, n.e.s	125	320	--	All to United Kingdom.
Oxides, hydroxides, peroxides, n.e.s	1	NA	NA	NA.
Waste and sweepings of precious metals value	NA	$173,819	$173,819	
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc kilograms	434	NA	NA	NA.
Grinding and polishing wheels and stones	69	41	--	NA.
Asbestos	1	65	--	Cuba 23.
Boron materials:				
Crude natural borates	11,099	14,255	--	All to Brazil.
Oxide and acid	244	1,556	216	Brazil 1,335; Ecuador 5.
Borates (refined) and perborates	6,808	7,156	--	Brazil 7,148; Uruguay 8.
Cement	5,449	5,966	--	Bolivia 4,801.
Chalk	388	310	--	All to Paraguay.
Clays and clay products:				
Crude:				
Bentonite	9,984	6,580	--	Brazil 4,205; Chile 1,722; Bolivia 430.
Kaolin	103	74	--	Paraguay 39; Uruguay 35.
Other	NA	286	--	Uruguay 255; Chile 30; Bolivia 1.
Products:				
Refractory (including nonclay brick and cement)	469	408	NA	Paraguay 238; Bolivia 81.
Nonrefractory	944	1,216	--	Paraguay 581; Bolivia 547.
Diatomite and other infusorial earth	16	316	--	Brazil 300; Paraguay 16.
Feldspar	NA	12	--	Paraguay 10; Brazil 2.

See footnotes at end of table.

Table 2.—Argentina: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude, nitrogenous	5	5	--	All to Paraguay.
Manufactured, unspecified	4	890	--	Bolivia 649.
Ammonia	153	NA	NA	NA.
Fluorspar	240	271	--	Chile 130; Venezuela 100; Ecuador 40.
Graphite, manufactured	2	1	--	Mainly to Brazil.
Gypsum and plasters	21,751	9,406	--	Uruguay 6,440; Paraguay 2,966.
Lime	2,115	3,430	--	Paraguay 3,334.
Lithium and lithium compounds	220	NA	NA	NA.
Mica:				
Crude including splittings and waste	3,884	3,031	--	West Germany 1,727; United Kingdom 1,063; Switzerland 233; Uruguay 8.
Worked including agglomerated splittings kilograms	122	NA	NA	NA.
Pigments, mineral:				
Natural, crude	3	NA	NA	NA.
Iron oxides, processed	174	120	--	Ecuador 29; Venezuela 26; Chile 18; Colombia 13.
Precious and semiprecious stones except diamond, natural kilograms	211	NA	NA	NA.
Salt	25,395	22,575	--	Paraguay 21,750; Nigeria 500; Zaire 320.
Sodium and potassium compounds, n.e.s	2	2,116	--	Chile 2,095; Paraguay 21.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	14,336	11,058	20	Italy 8,368; Spain 1,022; West Germany 734.
Worked	1,431	1,562	132	Japan 779; Italy 166.
Ornamental stone:				
Onyx, all forms	30	1,046	46	Italy 480; Japan 202.
Rhodochrosite, all forms	3	6	(2)	Mainly to West Germany.
Dolomite	3,112	2,990	--	All to Chile.
Gravel and crushed rock	119	20	--	All to Paraguay.
Quartz	25	70	--	Chile 30; Paraguay 20; Brazil 15; Uruguay 5.
Sand excluding metal-bearing	33	NA	NA	NA.
Sulfur:				
Elemental	30	5	--	Mainly to Paraguay.
Sulfur dioxide	1	NA	NA	NA.
Sulfuric acid including oleum	107	NA	NA	NA.
Talc, steatite, soapstone, pyrophyllite	362	266	--	Chile 265; Paraguay 1.
Other:				
Crude	220	1,066	--	Brazil 753; Chile 154; Paraguay 103.
Slag, dross, and similar waste, not metal-bearing	1,802	1,838	NA	United Kingdom 1,307.
Bromine, fluorine, iodine	2	NA	NA	NA.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium	4	NA	NA	NA.
Building materials of asphalt, asbestos, and fiber cements, and unfired nonmetals, n.e.s	242	2,519	--	Bolivia 1,695; Paraguay 655.
Activated natural mineral products	2,481	41	--	Paraguay 37; Uruguay 4.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	152	90	--	Brazil 50; West Germany 20; Australia 10; Chile 10.
Carbon black	3,865	NA	NA	NA.
Coal, all grades including briquets	638	661	NA	NA.
Coke and semicoke	56,336	14,543	--	Netherlands 14,004.
Gas, natural million cubic feet	480	286	--	All to Paraguay.
Peat including briquets and litter	125	5	--	All to Brazil.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	146	4	--	All to Paraguay.
Kerosine and jet fuel do	NA	35	34	NA.
Distillate fuel oil do	212	NA	NA	NA.
Residual fuel oil do	1,254	2,389	1,413	Paraguay 337; Uruguay 278; Netherlands Antilles 234.
Lubricants do	5,152	24	NA	Uruguay 19; Paraguay 3.
Other:				
Liquefied petroleum gas do	106	NA	NA	NA.
Mineral jelly and wax do	34	41	--	Bolivia 12; Chile 6; Ecuador 6.
Bitumen and other residues do	48	NA	NA	NA.
Bituminous mixtures, n.e.s do	31	NA	NA	NA.
Petroleum coke do	1,560	NA	NA	NA.
Unspecified do	24	3,052	1,605	Brazil 434; Netherlands 423; Japan 376.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	315	12,840	5,304	Netherlands 3,929; Belgium-Luxembourg 3,038.

rRevised. NA Not available.
[1]Includes tin-silver concentrates.
[2]Less than 1/2 unit.

Table 3.—Argentina: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	20,456	18,560	793	Guyana 14,352; Brazil 2,025; Denmark 1,390.
Oxide (alumina) and hydroxide	150,431	NA	NA	NA.
Metal including alloys, all forms	393	302	55	United Kingdom 73; West Germany 48; Switzerland 46.
Antimony:				
Ore and concentrate	368	NA	NA	NA.
Metal including alloys, all forms	(1)	NA	NA	NA.
Arsenic:				
Trioxides and acids	322	NA	NA	NA.
Metal including alloys, all forms	1	NA	NA	NA.
Bismuth metal including alloys, all forms	13	NA	NA	NA.
Cadmium metal including alloys, all forms	21	NA	NA	NA.
Chromium:				
Chromite	4,562	1,985	NA	Mainly from Republic of South Africa.
Oxides and hydroxides	3	NA	NA	NA.
Metal including alloys, all forms	38	NA	NA	NA.
Cobalt:				
Oxides and hydroxides	10	NA	NA	NA.
Metal including alloys, all forms	78	NA	NA	NA.
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	99	NA	NA	NA.
Copper:				
Ore and concentrate	2,151	NA	NA	NA.
Metal including alloys, all forms	37,161	31,849	64	Chile 28,062; Peru 2,905.
Gold metal, unwrought or partly wrought troy ounces	6,237	NA	NA	NA.
Iron and steel:				
Ore and concentrate thousand tons	2,377	2,395	NA	Brazil 1,861; Peru 251; Chile 175; Liberia 69.
Metal:				
Scrap	160,189	16,391	15,527	NA.
Pig iron and spiegeleisen	135,619	39,580	--	All from Brazil.
Sponge iron, powder, shot	1,676	1,359	813	West Germany 348.
Ferroalloys	7,133	3,336	53	Republic of South Africa 1,617; West Germany 640; Sweden 425.
Steel, primary forms	850,514	351,519	NA	Japan 121,329; Italy 90,406; Austria 46,442.
Semimanufactures:				
Common steel:				
Bars, rods, angles, shapes, sections	r28,618	20,237	4,282	Japan 4,162; West Germany 3,441; Brazil 2,438.
Universals, plates, sheets	r132,005	109,119	3,976	Japan 54,521; West Germany 20,684; Brazil 2,885.
Hoop and strip	r4,452	3,095	885	Japan 622.
Rails and accessories	3,502	18,093	212	Austria 17,400; West Germany 252.
Wire	785	2,268	55	Uruguay 1,270; Sweden 281.
Tubes, pipes, fittings	23,956	34,907	1,530	Netherlands 22,002; Japan 3,463.
Castings and forgings, rough	97	172	70	NA.
High-carbon and alloy steel, all forms thousand tons	32	(2)	NA	NA.
Lead:				
Ore and concentrate	1,666	NA	NA	NA.
Oxides	15	NA	NA	NA.
Metal including alloys, all forms	71	NA	NA	NA.
Magnesium metal including alloys, all forms	682	NA	NA	NA.
Manganese:				
Ore and concentrate	121,416	43,509	NA	Brazil 42,486.
Oxides	1,228	NA	NA	NA.
Metal including alloys, all forms	219	NA	NA	NA.
Mercury 76-pound flasks	1,961	NA	NA	NA.
Molybdenum:				
Ore and concentrate	19	NA	NA	NA.
Metal including alloys, all forms	13	NA	NA	NA.
Nickel metal including alloys, all forms	984	848	311	Republic of South Africa 162; Canada 100; United Kingdom 82.
Platinum-group metals including alloys, unwrought or partly wrought value, thousands	$307	$374	NA	West Germany $215.
Rare-earth metals and compounds	56	NA	NA	NA.
Selenium, elemental	10	NA	NA	NA.
Silver metal including alloys, unwrought or partly wrought value, thousands	$1,045	$2,305	$792	Belgium-Luxembourg $481; West Germany $223; United Kingdom $212.
Tellurium kilograms	54	NA	NA	NA.
Tin:				
Ore and concentrate	--	100	--	All from Bolivia.
Metal including alloys, all forms	630	668	NA	Bolivia 399; Brazil 265.

See footnotes at end of table.

Table 3.—Argentina: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	2,053	NA	NA	NA.
Oxides	720	NA	NA	NA.
Metal including alloys, all forms	46	NA	NA	NA.
Tungsten metal including alloys, all forms	117	NA	NA	NA.
Zinc:				
Ore and concentrate	1,168	NA	NA	NA.
Oxides	143	NA	NA	NA.
Metal including alloys, all forms	2,379	537	NA	Peru 300; Canada 200.
Zirconium ore and concentrate	92	NA	NA	NA.
Other:				
Ores and concentrates, n.e.s	1,204	4,213	NA	Australia 2,223; Canada 650; Austria 570.
Oxides, hydroxides, peroxides, n.e.s	1,015	NA	NA	NA.
Metals including alloys:				
Metalloids	3,031	NA	NA	NA.
Pyrophoric alloys kilograms	855	NA	NA	NA.
Base metals including alloys, all forms, n.e.s	6	382	229	Belgium-Luxembourg 31; France 11.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	373	NA	NA	NA.
Grinding and polishing wheels and stones	128	212	58	Brazil 63; West Germany 24.
Asbestos	20,333	13,368	NA	Canada 7,207; Republic of South Africa 6,155.
Barite and witherite	2,953	NA	NA	NA.
Boron materials:				
Borates and perborates	114	NA	NA	NA.
Boric acid	1	NA	NA	NA.
Bromine	49	NA	NA	NA.
Cement	2,937	3,166	674	France 887; West Germany 224.
Chalk	361	NA	NA	NA.
Clays and clay products:				
Crude:				
Bentonite	1	NA	NA	NA.
Fire clay	128	NA	NA	NA.
Kaolin	17,778	NA	NA	NA.
Andalusite, kyanite, sillimanite	306	NA	NA	NA.
Other	349	NA	NA	NA.
Products:				
Refractory (including nonclay brick)	18,175	33,183	5,712	Brazil 7,999; Uruguay 2,608; France 452.
Nonrefractory	5,260	11,309	NA	Italy 6,059; Uruguay 2,608; Brazil 2,211.
Cryolite and chiolite	72	NA	NA	NA.
Diamond:				
Industrial value, thousands	$664	$316	$121	Belgium-Luxembourg $133.
Powder thousand carats	368	NA	NA	NA.
Diatomite and other infusorial earth	3,772	NA	NA	NA.
Feldspar and fluorspar	2	NA	NA	NA.
Fertilizer materials:				
Crude:				
Nitrogenous	5,080	5,530	--	All from Chile.
Phosphatic	11,500	4,000	--	All from Tunisia.
Manufactured:				
Nitrogenous	4,873	5,416	NA	West Germany 3,425; France 800; Brazil 330.
Phosphatic	14,776	12,886	7,682	Brazil 3,200.
Potassic	9,491	12,269	7,330	Israel 2,799; West Germany 1,688.
Other including mixed	34,652	46,564	43,505	NA.
Ammonia	(1)	NA	NA	NA.
Graphite, natural	573	NA	NA	NA.
Iodine	9	NA	NA	NA.
Magnesite	24,319	NA	NA	NA.
Mica:				
Crude including splittings and waste	19	NA	NA	NA.
Worked including agglomerated splittings	25	16	NA	NA.
Pigments, mineral:				
Natural, crude	42	NA	NA	NA.
Iron oxides, processed	166	NA	NA	NA.
Precious and semiprecious stones except diamond thousand carats	33,545	(3)	NA	NA.
Pyrite	66	NA	NA	NA.
Salt and brines	10	NA	NA	NA.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	41,840	NA	NA	NA.
Caustic potash	526	NA	NA	NA.
Soda ash	156,870	NA	NA	NA.

See footnotes at end of table.

Table 3.—Argentina: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	732	NA	NA	NA.
Worked	(1)	NA	NA	NA.
Dolomite, chiefly refractory grade	4,654	NA	NA	NA.
Gravel and crushed rock	38	NA	NA	NA.
Quartz and quartzite	446	NA	NA	NA.
Sand excluding metal-bearing thousand tons	45	NA	NA	NA.
Sulfur:				
Elemental:				
Colloidal	107	NA	NA	NA.
Other than colloidal	80,558	71,200	25,265	Canada 29,535; Mexico 11,000; Poland 5,400.
Sulfuric acid including oleum	428	1,381	NA	NA.
Talc, steatite, soapstone, pyrophyllite	253	NA	NA	NA.
Other:				
Crude	3,138	NA	NA	NA.
Slag, dross, and similar waste from iron and steel manufacture, not metal-bearing	25	NA	NA	NA.
Oxides, hydroxides, and peroxides of magnesium, strontium, barium	169	NA	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	220	91	--	NA.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	32	NA	NA	NA.
Carbon black	824	NA	NA	NA.
Coal, all grades including briquets thousand tons	1,254	955	485	Poland 299; Colombia 145; Canada 23.
Coke and semicoke	793	4,702	--	All from West Germany.
Gas, natural million cubic feet	115,738	110,088	--	Bolivia 58,714; Chile 33,417; Venezuela 10,607; Saudi Arabia 5,339.
Hydrogen, helium, rare gases kilograms	22,671	NA	NA	NA.
Peat including briquets	55	NA	NA	NA.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	24,141	14,343	--	Gabon 9,737; Nigeria 1,892; Venezuela 1,189.
Refinery products:				
Gasoline do	142	56	--	All from Uruguay.
Kerosine do	46	207	--	All from Italy.
Distillate fuel oil do	4,201	1,404	--	Italy 615; Netherlands Antilles 424; U.S.S.R. 207; Brazil 158.
Residual fuel oil do	(1)	NA	NA	NA.
Lubricants do	159	254	62	Romania 73; Spain 58; France 54.
Other:				
Liquefied petroleum gas do	25,427	NA	NA	NA.
Nonlubricating oils, n.e.s. do	1	NA	NA	NA.
Mineral jelly and wax do	6	3	2	NA.
Unspecified do	174	292	207	West Germany 57; Brazil 9.
Total do	30,156	NA		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	42,040	55,700	39,562	Venezuela 15,941.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Included under "Common steel."
[3]Value only reported at $149,000.

COMMODITY REVIEW

METALS

Aluminum.—For several years Aluminio Argentino S.A.I.C. has operated a 140,000-ton-per-year aluminum smelter at Puerto Madryn based on local hydroelectric power. The Argentine Government in a recent international aluminum congress held in Madrid, Spain, announced that a second multibillion-dollar project to build up a new aluminum industry in the south of the country is being planned based on local

hydroelectric resources that are estimated at up to 6,000 megawatts. The Argentine Government was expected to call for prequalifying bids in early 1981 for the construction of a 140,000-ton-per-year aluminum smelter and related infrastructure costing $800 million. The smelter output would all be exported. Argentina's present Puerto Madryn smelter can cover local demand for some time to come. Current demand is 70,000 to 80,000 tons per year. The Government is looking for foreign investors to develop the massive hydroelectric resources of the Santa Cruz River. Initially, the proposed aluminum installation would use natural gas and coal, which are available locally, but it would use hydroelectric power once generating capacity was installed (taking about 10 years). Suggested locations for the aluminum smelter installation are the ports of Río Gallegos or Puerto Santa Cruz.

Production of primary aluminum during 1980 increased 9%, while exports rose 40% to 67,000 tons.

Table 4.—Argentina: Aluminum statistics

(Metric tons)

Year	Primary production	Secondary production	Imports	Apparent[1] consumption
1970	--	5,500	50,701	56,596
1971	--	8,000	59,337	67,743
1972	--	8,000	72,800	88,801
1973	--	8,000	69,030	81,297
1974	999	9,500	85,556	95,277
1975	23,710	10,500	45,813	79,761
1976	43,122	9,500	20,232	70,741
1977	49,875	6,500	108	54,133
1978	53,098	8,000	--	54,136
1979	126,393	10,000	--	84,477
1980	137,644	[e]10,000	--	NA

[e]Estimated. NA Not available.
[1]Excludes stock variations.

Source: Consejo Tecnico de Inversiones S.A. (Buenos Aires). Anuario-1979 (The Argentine Economy 1979), p. 259.

Copper.—Of great significance to the future of Argentina's mining industry is the massive El Pachón porphyry copper deposit under development by the St. Joe Minerals Corp. Drilling has revealed approximately 800 million tons of mineralization averaging 0.67% copper and 0.016% molybdenum, together with minor gold values. Further work on the project had been delayed pending the issuance of a new Argentine Mining Promotion Law. This law has now been enacted and has given St. Joe a basis for negotiating with the Government the terms for full development of El Pachón. The project involves a fully integrated operation to produce 100,000 tons per year of electrolytic copper (at a mining rate of 35,000 tons per day), 350,000 tons per year of sulfuric acid; 1,700 tons per year of molybdenum concentrate; and 200 tons per year of anodic bars with values in silver, gold, selenium, and tellurium. At this rate of annual production, the verified reserves insure a minimum life of 43 years. The estimated cost to build and start the El Pachón complex is $1,400 million. St. Joe's operating company, Cía Minera Aguilar S.A. (CMA), has withdrawn as the principal financier but is desirous of retaining management of the project. Other major mining companies and the State have been invited to participate in this project in San Juan Province. Latest projections, assuming all tentative investment commitments are met, envisage startup of production in late 1984, reaching a full-capacity production of 1,000 tons per day of concentrate by mid-1985.

Three of Argentina's largest known copper and precious metal deposits will be tendered in early 1981 to private international and local companies under provisions of the code. The Bajo de la Alumbrera copper-gold deposits in Catamarca Province and the Famatina copper-molybdenum deposit in La Rioja Province will be tendered internationally. The Farallón Negro Mine (gold, silver, and manganese) in Catamarca will be offered to a local firm, which may be formed with up to 40% foreign capital: The Bajo de la Alumbrera prefeasibility study made by Kaiser Engineers Co. of the United States summarized the outstanding aspects of the project study as follows: The reserves are estimated at approximately 450 million

tons; the overall grade of 0.85% equivalent copper corresponds to an average grade of 0.56% copper, plus 0.68 gram per ton of gold, 2.5 grams per ton of silver, and 0.08% molybdenum; the La Alumbrera deposit has a favorable geographical situation near the Farallón Negro project and other potential copper deposits of the same type and has access to railways and roads. In the project, the most favorable operative stage compatible with reserves and needs of the country, is the production of 60,000 tons of electrolytic copper per year. For this production it is necessary to treat 12 million tons per year, or 37,000 tons per day, of ore. The byproducts would be approximately 8 tons of gold, 10 tons of silver, 220,000 tons of sulfuric acid, and 500 tons of molybdenum concentrate per year. The estimated reserves indicate that exploitation may last from 25 to 30 years.

The Famatina copper-molybdenum deposit has been under exploration by the Mining Secretary of State since 1975. A drilling program is underway to determine its economic feasibility. In 1978 Fabricaciones Militares joined the exploration committee formed by the Province and the Mining Secretary of State. Drilling results obtained to date are encouraging. In the mineralized levels, molybdenum disulfide exceeds 0.06% and under extreme conditions reaches 0.1%. Copper grade levels range between 0.2% and 0.5%.

Iron Ore.—The iron and steel industry made a new advance in 1979 with the startup of iron ore and pellet production from the Sierra Grande magnetite deposits in Río Negro Province. Iron ore reserves published by the operating company, Hierro Patagónico S.A., amount to 139 million tons (proven) and 124 million tons (probable), averaging 55% iron and approximately 1.4% phosphorus. Production for 1980 was 710,000 metric tons compared with the initial output of 611,000 metric tons in 1979, increasing ore stocks to 3 million tons. The concentrator produced 581,000 metric tons of concentrate and 350,000 metric tons of pellets averaging 68% iron and 0.17% phosphorus. Pellet production commenced in June 1979, and the first 30,000 tons was shipped through Puerto Buitrago in September. A pellet production of over 2 million tons is projected for 1981.

Other production of iron ore is derived from mines at Nueve de Octubre (Jujuy) and Unchime (Salta) for the Zapla smelter; reserves were estimated at 700 million tons. Output amounted to approximately 500,000 metric tons per year. Imports of iron ore to satisfy the steel industry required a $75.9 million expenditure in 1980. According to Argentine expansion plans for the steel industry, iron ore requirements will grow as shown below, in million tons of iron ore and million U.S. dollars:

Year	Total demand (million tons)	Domestic production capacity (million tons)	Imports required (million tons)	Estimated total value of imports (million U.S. dollars)
1980	4.5	2.2	2.3	75.9
1985	6.6	2.2	4.4	145.2
1990	8.7	2.2	6.5	214.5

Iron and Steel.—Crude steel output in 1980 declined 12%. Pig iron output decreased 5.0% compared with 1979 levels. Sponge iron production increased slightly (2.0%). There were two operating direct-reduction facilities in Argentina, ACINDAR S.A. and Dalmine-Siderca S.A.I.C.; both used the Midrex process and natural gas fuel, and both produced billets used in electric arc furnaces.

ACINDAR S.A., Argentina's largest private sector steelmaker, has an annual capacity of 462,000 metric tons of sponge iron (93% iron) per year. ACINDAR is currently uprating its No. 2 rodmill. When the expansion is completed in late 1981, ACINDAR's Nos. 1 and 2 rodmills are expected to have a combined output of 900,000 metric tons per year.

Dalmine-Siderca S.A.I.C., part of the Italian Techint Group, has a annual capacity of 330,000 metric tons of sponge iron. No expansion plans have been reported. Siderúrgica del Sur (SIDERSUR), a consortium of Argentine minimills, has signed a letter of intent with Hojalata Y Lamina (HYL) (Alfa Group) of Mexico for a direct-reduction plant to be built on one of two coastal sites south of Buenos Aires, depending on studies on the availability of natural gas. The consortium plans to install a 500,000-metric-ton-per year HYL III continuous direct-reduction plant. The plant could be in operation by late 1983.

Japan's involvement in Argentina's Sociedad Mixta Siderúrgia Argentina (SOMISA) project may be frozen following the breakdown of talks over the supply of Japanese equipment for a hot strip mill at the plant. Japanese companies earlier

agreed to invest $30 million in the project, and $20 million was to come from Japan's Overseas Economic Cooperation Fund and the Export Import Bank; however, there are indications that this funding is dependent on the satisfactory conclusion of the contract for the hot strip mill. The Federal Republic of Germany is also involved in funding $800 million worth of German equipment. The Argentine Government was expected to request $125 million worth of Japanese equipment and had asked Japan to install not only its own equipment but also the German equipment. The collapse of negotiations between Argentina and Mitsubishi Heavy Industries Inc., Mitsubishi Corp., and Ishikawa-Jima-Harima Heavy Industries Co. could mean that the agreement on Japanese financing will be delayed. SOMISA plans to raise raw steel capacity from 2.7 million tons to 4 million tons per year.

Table 5.—Argentina: Iron and steel production

(Thousand metric tons)

Year	Pig iron	Sponge iron	Crude steel[1]	Hot-rolled steel			Cold-rolled steel
				Total	Nonflats[1]	Flats[1]	Flats[2]
1975	1,042	--	2,300	2,196	1,404	792	760
1976	1,288	8	2,406	2,004	1,244	760	712
1977	1,100	285	2,678	2,356	1,323	1,033	871
1978	1,435	390	2,780	2,205	1,370	835	795
1979	1,114	803	3,197	2,593	1,576	1,017	870
1980[e]	1,068	816	2,808	2,036	1,376	660	648

[e]Estimated.
[1]Includes structural steel and others.
[2]Includes plate and tin plate.

Source: Siderúrgia, July, August, September 1980, No. 25 (Instituto Argentino de Siderúrgia-IAS).

Lead, Silver, and Zinc.—CMA, St. Joe's subsidiary, which has operated since the 1930's, produced 73,200 tons of zinc concentrate and 43,900 tons of lead concentrate containing 1.7 million troy ounces of silver compared with 80,700 tons, 42,500 tons, and 1.7 million troy ounces, respectively, in 1979. CMA's higher profitability in 1980 was due primarily to higher silver prices and sales from inventory. Driving of a new adit (tunnel) at Aguilar to facilitate ore extraction and to gain access to mineralization at lower levels continued in 1980. The lower tunnel should be completed in 1982 and is expected to reduce ore and material handling costs.

Manganese.—Within the mining property of Yacimientos' Mineros de Agua de Dionisio, located in the Belén Department, Catamarca Province, there are two types of ore mineral deposits: Very long and strong veins (Farallón Negro, Alto de la Blenda), and an area of hydrothermal alteration with a disseminated mineralization (Bajo La Alumbrera, El Durazno, San Lucas, etc.). At the Farallón Negro area the estimated reserves are: 801,400 tons (proved) with 9 grams per ton of gold, 161 grams per ton of silver, and 15.9% manganese with 500,000 tons of probable reserves.

At the area of hydrothermal alteration, suitable for leaching with possibilities for open pit mining, proved reserves amount to 355,000 tons with 3 grams per ton of gold, 72 grams per ton of silver, and 12.2% manganese. The Alto de la Blenda discovery in the Farallón Negro area has 3 million tons of indicated reserves, grading only 8.7% manganese, with gold and silver values. The current work schedule of the project involves the processing of 350 tons per day of ore, with a production of 25,000 tons per year of manganese concentrate containing 38% manganese, 19,870 troy ounces of gold, and 80,400 troy ounces of silver.

In 1980, production of manganese declined 5%. Consumption of manganese in steelworks and ferroalloy plants continued high and was estimated at 76,000 tons per year, most of which has to be imported.

NONMETALS

Cement.—Among the many important construction projects during 1979-80, the following were outstanding. Cementos Loma Negra S.A. invested $32 million in the Olavarría plant, to expand capacity to 500,000 tons per year. In 1980, the company set up a new cement plant in Catamarca Province at a cost of $60 million.

Juan Minetti S.A. initiated the construc-

tion of a new $150 million cement plant in the locality of Puesto Viejo, in the Province of Jujuy, with an annual capacity of 720,000 tons. This company started its activities in 1932 under the name of Compañía Sudamericana de Cemento Portland Juan Minetti e Hijos Ltda. S.A., and has since expanded its production capacity steadily.

Production of cement in Argentina increased 5.6% in 1980, exceeding 7 million tons, and was the largest output in the last 10 years. The five portland cement production areas in the country follow:

Production area	Installed annual capacity (thousand metric tons)	Production (thousand metric tons)	
		1979	1980
Buenos Aires and Neuquén	5,785	4,453	4,729
Córdoba and Entre Ríos	1,967	1,199	1,129
Mendoza and San Juan	710	574	522
Catamarca, Santiago del Estero, and Salta	1,224	341	536
Chubut	163	135	142
Total	9,849	6,702	7,058

Boron Minerals.—Several studies were made on borate deposits in the Provinces of Jujuy and Salta by the Government of Jujuy, including the deposits known as La Angelina, La María, La Leonor, La Miguela, La Teresa, Las Afortunadas, and Demasía Federico, and the group of deposits known as the Salta Group located in the Guayatayoc Lake in the locality of Tumbaya and Cochinoca in Jujuy Province.[3] Production of borates in Argentina increased 4% in 1980.

Fluorspar.—The Mining Secretariat has approved a new development project for fluorspar in Guanaquinto, Chubut, which will be investigated for 14 months by Puerto Lobos S.A. In accordance with the new mining legislation, the Government will assume 80% of the exploration risks. The Government also granted a loan for a fluorspar prospecting venture at the María and Facundo Mines in Santa Cruz Province. This loan of $541,000 was granted to Construcciones, Estudios y Proyectos S.A., which must finish excavation and drilling and provide samples within 19 months. Fluorspar production in 1980 increased 10%.

Sulfur.—In 1978, Argentina imported $5.2 million worth of sulfur for the manufacturing of fertilizer. The last production of sulfur on record in Argentina was 17,771 metric tons of concentrates derived from Caliche in 1978, before main production centers in Mendoza and Salta were shut down because of high production costs. From 1979 to date, the total domestic consumption of sulfur has been imported. A great amount of the imported sulfur is utilized in manufacturing sulfuric acid. Sulfur imports are expected to decrease when the new copper projects are in production.

MINERAL FUELS

Coal.—In 1980 production of run-of-mine coal decreased 31%, or 436,463 metric tons, while output of salable coal after beneficiation decreased 46%. Coal transported by rail from the mines at Río Turbio, where 99% of Argentina's known coal deposits are located, to the port of Río Gallegos amounted to 308,436 metric tons, a 42% decrease. The following table shows the breakdown of sales of coal produced at Río Turbio during 1980, in metric tons:

Consumer	Quantity
Agua y Energía Electria	198,183
SEGBA (Buenos Aires Electric Co.)	83,708
FF. CC. A. (railroad)	2,018
Exports to Uruguay	650
Buenos Aires	3,549
Río Gallegos (port)	11,844
Río Turbio (mine site)	8,484
Total	308,436

Imports of bituminous coal in 1980 amounted to about 922,000 tons valued at $73 million. Most of the coal imports (84%) were from the United States, with the balance from Poland (9%), and elsewhere (7%).

Natural Gas.—The Inter-American Development Bank granted a loan of $87 million to Gas del Estado (the State gas company) for the construction of the General San Martín gas pipeline (planned to begin operation in early 1981) to transport Tierra del Fuego gas, which until now was either reinjected or flared. The pipeline consists of three sections. The first section,

about 100 kilometers in length, joins the production area at San Sebastían in Tierra del Fuego with Cabo Santo Espíritu at the southern entrance to the strait of Magellan; the second section, 37 kilometers long, is an underwater arc joining the north of the island with Cape Vírgenes, at the extreme continental end of Santa Cruz; and the third section, 40 kilometers long, runs from Cabo Vírgenes to the compressor plant at El Cóndor, where it joins the Austral pipeline to Buenos Aires.

While this work was in progress, Gas del Estado enlarged the compressor plant at Pico Truncado, installed a new one at San Julían, and carried out various accessory works for the General San Martín pipeline, thus increasing the injection and transport capacity of the Austral pipeline. Similar work was carried out on the North pipeline to increase gas volumes from Bolivia and the north.

The General Cerri petrochemical plant was completed in 1980 and is of outstanding importance to the Argentine economy, because it will handle 18 million cubic meters per day of natural gas from which high-quality gases will be extracted. General Cerri will provide about 300,000 tons of liquid petroleum gas per year, and the estimated savings are about $120 million.

The Center West gas pipeline, approximately 1,100 kilometers long, was under construction. The line will transport natural gas under toll charges from the Neuquén Basin, at the Loma de la Nata Field, to the consumption centers of the Provinces of Mendoza, San Juán, San Luís, and Córdoba, the littoral area, Santa Fé, and the Buenos Aires area at a rate of 5 million cubic meters per day in the first stage, at 7 million cubic meters per day 1 year after commissioning, and at 10 million cubic meters per day 2 years later. YPF has been granted a $560 million loan from a consortium headed by the Deutsche Genossen-Schaft Bank and Lloyds Bank International to help finance the Center West natural gas pipeline.

The Government has approved a feasibility study for the construction of a $2.5 billion petrochemical complex 400 kilometers north of Buenos Aires. The plant is to be built by Petroquímica San Lorenzo and would be Argentina's first petrochemical plant owned entirely by private interests. Output of the San Lorenzo plant would include 300,000 tons per year of ethylene, 165,000 tons per year of propylene, 107,000 tons per year of butylene and butadiene mixture, and 261,000 tons per year of benzene, toluene, and xylene. Cost of the main cracking plant is estimated at $500 million.

Argentina is to increase its imports of natural gas from Bolivia from 180 million to 230 million cubic feet per day; at the same time the price will go up from $3.44 to $4.06 per thousand cubic feet. An agreement was reached by Argentina and Brazil to study the feasibility of building a pipeline to ship natural gas to Brazil. The project, involving 2,200 kilometers of pipe, would cost $2 billion and involve 10 million cubic meters per day. Gas del Estado and Petroleo Brasileiro S/A of Brazil were to produce a feasibility study before the end of 1981.

The World Bank made a loan of $27 million to Argentina for oil and gas engineering projects in order to support the Government's effort to achieve energy self-sufficiency. The project is the World Bank's first operation in Argentina's hydrocarbon sector.

Proven reserves of natural gas at yearend were estimated at 641.1 billion cubic meters (22.6 trillion cubic feet), up from 600.3 billion cubic meters (21.2 trillion cubic feet) in 1979 and 432.2 billion cubic meters (15.3 trillion cubic feet) in 1978. The notable increase in 1979 was attributed to the discovery of two large fields in Neuquén Province with proven reserves of 314,000 million cubic meters.

Natural gas wellhead injection to pipelines rose 7.5% to 9,871.5 million cubic meters in 1980.

Imports of petroleum, petroleum products, natural gas, liquid gas, and coal amounted to $1.06 billion in 1980 compared with $1.12 billion in 1979, a decrease of 5.4%. The sharpest decrease in imports was in gas and oil, 98%.

Exports of petroleum products and residual coal in 1980 rose to $266 million compared with $51 million in 1979.

Petroleum.—Although crude oil production increased 6.8%, imports of oil reached 16.0 million barrels in 1980 valued at $539 million, or 52% above the 1979 import cost. Secondary recovery is expected to account for 27% of total production in 1983 versus 15% in 1980. The number of operators involved in secondary recovery operations in Argentina rose to 28 from only 6 in 1977. Private rig utilization jumped to 50 units, up 50% from 1977. YPF cut its number of rigs in operation 20%, but increased drilling

productivity.

Argentina has launched an ambitious effort to become energy self-sufficient by the end of the century. That effort involves an increase in the Nation's oil reserves to 6.3 billion barrels by the year 2000 from its current 2.5-billion-barrel reserve level.

Argentina's new incentives in the oil sector have resulted in the growth of private firms and the influx of foreign capital into Argentina. Private operators invested more than $1.2 billion in the Nation's oil and gas development areas during 1978-80. They are expected to produce 44% of total output, or 82 million barrels per year by 1983, up from 36% of the current total.

Twenty-two new operators began operations in Argentina during the past 4 years, as oil production by private companies increased to 62.9 million barrels in 1980 from 37.7 million in 1976. Of the 19 international and 35 domestic firms operating under exploration and development contracts in Argentina, the biggest producers are Amoco Argentina Oil Co., with 30% of private output; Petrolera Perez Companc S.A., 27%; Argentina-Cities Service, 18%; and Bridas S.A.P.I.C., 10%.

Since issuance of Law 21.788 on "risk contracts" in 1978, the exploration of offshore and certain land areas has been undertaken by the private sector. To date, 7 offshore areas and 11 land areas have been tendered, and by March 1981, it is expected that a total of 21 areas will be tendered.

Drilling in a nearby offshore block by a consortium comprising Esso Exploradora Inc., Astra C.A.P.S.A., Petrolera Perez Companc S.A., and C.A.D.I.P.S.A. has been unsuccessful. A third group formed by Total, Bridas S.A.P.I.C., and Deminex S.A. has ordered a jack-up rig from the United States and will soon begin drilling in an offshore block near the Island of Tierra del Fuego. Private contractors have so far bid more than $200 million for exploration rights in four Tierra del Fuego offshore blocks.

The Argentine Government has signed an exploration and production contract covering a 927-square-mile area in west-central Argentina with Union Oil Co. of California. Union plans to drill five wells in a 171-square-mile sector of the area to determine feasibility of a thermal recovery process in a previously discovered heavy-oil reservoir and also plans to make a seismic survey in the rest of the area before beginning exploratory drilling. Union has a 50% interest in the area, which is in the Llancanelo region of the Neuquén Basin, about 25 miles east of Malargue.

An oil-drilling consortium led by Shell Hydrocarbons B.V., discovered oil in offshore coastal waters east of Tierra del Fuego. The well was drilled to a depth of 5,248 feet in 229 feet of water by the Interocean II jack-up rig and initially yielded 5,032 barrels of oil per day. The consortium, comprising Shell Hydrocarbons B.V., Shell C.A.P.S.A., and Petrolar S.A., is expected to drill another 14 wells under its 27-year contract. The group has already invested $50 million of the $160 million earmarked for the exploration phase of the contract.

Uranium.—*Nuclear Energy.*—According to CNEA the proved reserves amount to 28,000 tons of uranium oxide (U_3O_8, yellowcake), an increase of 6% compared with that of 1979. This increase resulted from expanded prospecting by CNEA with the assistance of private companies. A contract has been signed for the exploitation of the Los Gigantes deposit in Córdoba Province in an area that includes three uranium mines with estimated reserves of 1,500 tons of yellowcake. The exploitation of El Tigre I La Terraza zone in Sierra Pintada (Mendoza) is in the final negotiation stage, and operation is expected the first or second quarter of 1983. The country's requirements would then be supplied by these two projects, with an output of 100 tons per year of yellow cake from Los Gigantes and 700 tons from El Tigre I.

Prospecting continues at Los Adobes, near the Chubut River, where drilling has been done on three anomalies with results unknown. A 15-year contract to mine and process uranium ore in San Luis Province has been signed recently with Uranco, an Argentine mining company. The plant will be set up on the mining site to process an estimated 5,000 tons of uranium ore annually. Total production of uranium ore in Argentina has increased 7.5% to 210,877 tons.

CNEA, has announced a $10 billion, 20-year nuclear power program that calls for the construction of six nuclear power units by the year 2000. This will provide Argentina with 3,400 megawatts of nuclear generating capacity by the end of the century, which will account for at least 15% of the country's total electrical energy output. Argentina in 1974 became the first Latin American country to install a 374-megawatt nuclear reactor, Atucha I near Buenos Aires. Atucha I is a heavy-water plant, fueled by natural uranium in a Kraftwerk Union (KWU) West German-designed

reactor. Work is almost completed on a plant with similar capacity at Embalse, near Córdoba. The Atucha I nuclear plant is scheduled to get a twin Atucha II by 1988, which will be built in Zarate Province of Buenos Aires. In 1980, KWU won the contract to build the third nuclear plant, the 682-megawatt Atucha II unit. Two more plants are scheduled for construction in Cuyo and Noa Provinces by 1995 and three more plants may be added to the list by the end of the century. Argentina has 28,000 metric tons of proved reserves of uranium (yellow cake), enough to fuel eight 600-megawatt reactors for 30 years. A contract was awarded for the first commercial-scale, heavy-water production facilities which will be built in Arroyito, Provincia Neuquén to Switzerland's Sulzer Bros. Ltd., and Argentina has committed itself to safety checks on the plant by the International Atomic Energy Agency.

Argentina has already bought and taken delivery of 5,000 metric tons of heavy water (used for moderating and cooling nuclear reactors) from the U.S.S.R., and more will be purchased until the country has its own heavy-water plant in operation. The U.S.S.R. will provide components for future nuclear plants, as well as low-grade enriched uranium.

Argentina was negotiating with Brazil to put together a bidding consortium, based on KWU technology, to offer nuclear systems to the rest of Latin America. CNEA is also forming a joint engineering company with KWU (25% West German, 75% Argentine). Mexico and Chile have expressed active interest in the forthcoming Argentine-Brazilian bidding consortium.

Bolivia and Uruguay are beginning nuclear research programs with the help of Argentina. Argentina has agreed to provide Bolivia and Uruguay with a 10-megawatt research reactor in 5 years, and to train nuclear engineers and technicians. Argentina also has agreed to provide Uruguay with a feasibility study on building a larger scale nuclear reactor in the near future.

Argentina is about to take a further step in developing its nuclear technology by building an experimental plutonium reprocessing plant at the Ezeiza atomic center in Buenos Aires. The plant will be built entirely without foreign assistance.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Argentine pesos (M$N) to U.S. dollars at the rate of M$N1,996=US$1.00, the exchange rate as of Dec. 31, 1980.

[3]De Los Hoyos, L. The Recoverable Reserves of Boron Minerals in the Lake of Guayatayoc.

The Mineral Industry of Australia

By Charlie Wyche[1]

The overall improved performance of the Australian minerals industry in 1980 exceeded the high level of production and expansion established during 1979. While these improvements were influenced mostly by world conditions, they were also affected by the Federal Goverment's favorable domestic mineral policy, such as investment allowances and various tax concessions. With the Federal Government's approval to develop several new uranium mines, production began at one mine in May and is scheduled to commence at another in late 1981.

Diamond production commenced in 1980, with most of the activity concentrated around the Kimberlite pipes, in Western Australia. The Federal Government's efforts to tax the imputed value of subsidized mine housing resulted in a 10-week strike by Queensland coal workers. Also, in New South Wales, the railways and inadequate port facilities, and frequent industrial interruptions to the operations of these facilities, had a very damaging effect on the mining industry.

In 1980, the value of mine and quarry production was a record $5.8 billion,[2] an increase of 14% compared with the $5.1 billion reported in 1979. The approximately $6.5 billion value added by domestic smelting and other processing of mineral commodities credited the mineral industry with a total production value of $12.3 billion. This figure represents 9.3% of the $132 billion adjusted gross national product in 1980.

The Government has granted authority to the States to raise loan funds for infrastructure. As a result, New South Wales was planning to spend $89 million on improving coal loading facilities at Port Kembla and $200 million on the Eraring electric power stations and associated coal mines by 1983. Queensland was planning to invest over $2 billion in improving its coal loading facilities, expanding the aluminum industry, and in various electric powerplant extensions. Victoria was to spend $350 million on the Loy Yang brown coal powerplant and mine. Tasmania would invest $78 million on further hydroelectric works, and Western Australia was planning to borrow $420 million to construct a pipeline to carry North West Shelf gas to Perth and a further $110 million to integrate the electric power supply in the Pilbara iron mining area.

Private enterprise investment projects in the mining and manufacturing industries during the next 5 years, totaling more than $33 billion, are either ready to proceed or are in final feasibility stages. Expenditure for exploration remained at the previous year's level of $1 billion. In addition, a loan was made to the Federal Government of nearly $100 million to assist financing of infrastructure.

PRODUCTION

Mine output of most of the approximately 70 minerals produced in Australia in 1980 was at or above the level for 1979. The main exceptions were bauxite, alumina, and zinc. Despite a decrease in world steel output in 1980, Australian production of iron ore rose slightly; however, domestic pig iron and crude steel production declined as a result of industrial disputes. For the second time since the Australian aluminum industry

started to grow in the early 1960's, output of bauxite declined. Industrial disputes in the Darling Range, Western Australia, where production declined, and a cutback at Weipa, Queensland, were primarily the reasons for the decline. Mine production of nickel increased by 3%, and higher prices resulted in a 27% increase in export earnings in 1980. Lead production in all categories was down slightly in 1980, and mine production of zinc declined from the record output in 1979 owing to prolonged industrial stoppages. Copper ore and concentrate production declined slightly, but blister and refined copper production rose. This industry has been severely affected by depressed conditions in the market in recent years. As markets for titanium production firmed up in 1980, Australian production of rutile concentrates increased about 8% over the 1979 level. Production of zircon increased significantly as the decrease in Western Australia was more than offset by increased production on the east coast.

Western Australia and Queensland were Australia's largest mineral-producing States, accounting for 38% and 25%, respectively, of the total value of mineral output in 1980. New South Wales ranked third, accounting for 18% of the total value.

Production of the principal mineral-producing States and their respective values were as follows:

State	Minerals produced	Value (millions)
Western Australia	Iron ore	1,040
Do	Alumina (from bauxite).	422
Do	Nickel	227
Do	Petroleum (crude oil).	161
Queensland	Coal	748
Do	Copper	257
Do	Lead	157
Do	Silver	132

Table 1.—Australia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite, gross weight	24,084	26,086	24,293	27,585	27,178
Alumina	6,206	6,659	6,776	7,415	7,246
Metal, refined	232	248	263	270	303
Antimony, Sb content of antimony and lead concentrates	1,892	2,089	1,519	1,558	1,147
Bismuth, mine output, metal content	[r]769	[r]912	1,054	[e]1,000	[e]900
Cadmium:					
Mine output, metal content	1,533	1,567	1,528	1,794	1,733
Metal, smelter (refined)	649	[r]670	747	804	1,012
Chromium: Chromite, gross weight	--	--	776	NA	NA
Cobalt:					
Mine output, analytic content of:					
Nickel ore	2,129	2,077	2,418	2,498	2,354
Nickel concentrate	1,024	1,125	882	762	807
Zinc concentrate	97	122	93	97	84
Total	3,250	3,324	3,393	3,357	3,245
Recoverable cobalt[e]	550	1,000	1,350	1,500	1,600
Columbium-tantalum concentrates, gross weight[2]	124	158	125	312	373
Copper:					
Mine output, metal content	218,480	221,579	222,111	234,735	217,114
Metal:					
Smelter:					
Primary	167,346	167,664	164,395	166,260	171,353
Secondary	2,977	4,096	2,803	6,300	7,104
Refined:					
Primary	160,317	151,955	152,621	137,689	144,828
Secondary	28,014	[r]31,113	26,321	34,800	21,146
Gold:					
Mine output, metal content, troy ounces	502,741	[r]624,270	647,579	588,197	551,577
Metal, refined (excluding recovery from scrap), do	471,844	[r]552,317	578,327	533,798	474,576
Iron and steel:					
Iron ore:					
Gross weight, thousand tons	93,255	95,923	83,134	91,709	95,542
Iron content, do	58,567	60,463	52,825	58,013	[e]60,438
Metal:					
Pig iron, do	7,417	6,753	7,337	7,811	6,960

See footnotes at end of table.

Table 1.—Australia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Ferroalloys:[3]					
Ferromanganese, high-carbon	49,927	71,012	95,393	e72,000	e71,000
Ferrosilicon	r6,954	18,667	18,943	e19,000	e19,500
Silicomanganese	14,651	23,430	--	e24,000	e25,000
Total	71,532	113,109	114,336	e115,000	e115,500
Crude steel thousand tons	7,774	7,313	7,589	8,125	7,593
Semimanufactures do	5,957	6,743	6,975	7,043	e6,400
Lead:					
Mine output, metal content	397,403	432,204	400,291	415,785	397,880
Metal:					
Primary:					
Bullion, for export	160,690	156,403	151,964	169,469	160,174
Refined	181,941	181,501	204,022	215,734	200,451
Total	342,631	337,904	355,986	385,203	360,625
Secondary (excluding remelt)[e]	29,600	36,500	35,100	39,100	32,187
Manganese ore:					
Gross weight thousand tons	2,154	r1,389	1,249	1,666	1,961
Manganese content do	1,036	708	608	793	e933
Mercury 76-pound flasks	4	1	(4)	2	--
Nickel:					
Mine output, metal content	82,532	85,868	85,868	73,323	69,850
Metal, smelter (refined metal and metal content of oxide)	39,868	34,140	37,327	39,300	38,300
Platinum-group metals:[5]					
Palladium, metal content troy ounces	7,950	9,581	r e7,360	r e7,300	e7,200
Platinum, metal content do	3,158	3,697	e3,500	e3,000	e2,500
Ruthenium do	462	225	e300	e200	e150
Total do	11,570	13,503	11,160	10,500	9,850
Rare-earth metals, monazite concentrate:					
Gross weight	5,310	r9,379	14,992	16,206	13,749
Monazite content	4,906	8,507	13,938	14,584	e12,373
Silver:					
Mine output, metal content thousand troy ounces	25,034	27,525	26,123	26,816	25,369
Metal, refined do	8,187	9,006	9,599	9,469	9,761
Tin:					
Mine output, metal content	10,611	10,634	11,864	11,503	10,610
Metal, refined:					
Primary	5,603	5,561	5,129	5,423	4,686
Secondary	255	205	320	e325	e375
Titanium concentrates, gross weight:					
Ilmenite thousand tons	959	1,033	1,255	1,150	1,309
Leucoxene	12,233	10,621	16,104	21,773	e20,000
Rutile	389,750	325,281	257,075	278,901	293,748
Tungsten, mine output, metal content	1,989	2,358	2,707	3,167	3,316
Zinc:					
Mine output, metal content	r461,931	491,608	473,293	531,769	493,730
Metal, smelter:					
Dust	6,737	6,411	7,343	e6,800	e7,000
Primary	242,635	249,741	290,066	305,394	300,994
Secondary[e]	6,600	6,700	4,700	4,700	4,800
Zirconium concentrates, gross weight	420,185	398,229	391,606	446,980	459,039
NONMETALS					
Abrasives, natural:					
Beach pebble	1,547	1,290	1,578	e1,400	e1,500
Garnet (sales)	95	1,104	1,583	1,080	3,629
Asbestos	60,642	50,601	62,744	79,121	e80,000
Barite	14,133	11,675	13,790	10,825	e30,000
Cement, hydraulic thousand tons	5,062	5,022	4,993	5,243	5,387
Clays:					
Bentonite and bentonitic clay	11,954	5,603	4,656	8,969	e9,200
Brick clay and shale thousand tons	9,431	7,885	8,563	8,969	e9,000
Cement clay and shale do	r395	372	e350	e380	e400
Damourite clay (sales)	1,334	1,798	e1,800	e1,900	e1,900
Fire clay thousand tons	337	349	e340	e350	e360
Fuller's earth	9	50	e45	e50	e50
Kaolin and ball clay	69,303	88,884	89,200	90,700	e91,000
Other[6] thousand tons	425	446	e450	e475	e450

See footnotes at end of table.

Table 1.—Australia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Diatomite	1,480	1,288	2,821	588	[e]600
Diamond: Industrial thousand carats	--	--	--	--	48
Feldspar	4,519	1,877	3,185	4,340	[e]4,500
Gem stones value, thousands	$60,170	$63,100	$86,257	$89,349	[e]$90,000
Gypsum thousand tons	942	916	940	1,159	[e]1,200
Lime[7]	902,210	857,322	890,032	1,089,000	1,200,000
Magnesite	14,706	18,531	21,350	28,136	[e]29,000
Nitrogen: N content of ammonia	307,400	316,500	294,300	308,300	353,000
Perlite, crude	3,448	2,115	1,417	[e]2,700	[e]2,900
Phosphate rock	275,600	449,631	248,328	6,999	[e]4,500
Pigments, mineral, natural: Ocher	1,025	62	281	[e]50	[e]70
Pyrite including cuprous, gross weight	216,749	225,657	204,724	44,910	--
Salt thousand tons	5,489	4,715	5,766	[e]5,800	5,315
Sillimanite	567	550	568	568	[e]600
Sodium carbonate[e]	155,000	160,000	165,000	165,000	185,000
Stone, sand and gravel:					
Construction sand[6] thousand tons	24,264	25,600	23,264	[e]26,000	[e]26,000
Gravel[6] do.	15,640	15,483	14,176	[e]16,000	[e]16,000
Dolomite do.	589	537	638	726	[e]750
Limestone:					
For cement do.	7,673	7,399	7,693	[r e]7,800	[e]8,000
For other uses do.	[r]2,909	3,152	3,232	[r e]3,100	[e]3,200
Silica in the form of quartz, quartzite, glass sand do.	1,381	1,224	1,290	[e]1,300	[e]1,300
Other:					
Crushed and broken stone do.	53,033	54,398	56,910	[e]64,000	[e]64,000
Dimension stone[8] do.	112	84	115	[e]200	[e]200
Unspecified[9] do.	32,805	33,116	28,905	[e]44,000	[e]44,000
Sulfur:					
S content of pyrite	108,204	107,731	92,714	21,799	--
Byproduct:					
Metallurgy	129,960	121,140	[e]140,000	[e]140,000	140,000
Petroleum	6,588	10,590	10,000	11,000	11,000
Total	244,752	239,461	242,714	172,799	151,000
Talc, soapstone, pyrophyllite	92,097	112,920	146,954	156,870	[e]170,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous and subbituminous thousand tons	74,853	78,367	79,827	83,142	84,252
Lignite do.	30,940	29,250	32,860	32,597	32,895
Total do.	105,793	107,617	112,687	115,739	117,147
Coke:					
Metallurgical do.	[r]5,432	[r]4,834	5,103	8,140	[e]8,200
Gashouse (including breeze) do.	65	65	65	70	[e]80
Total do.	[r]5,497	[r]4,899	5,168	8,210	[e]8,280
Fuel briquets do.	959	941	1,129	1,157	1,200
Gas, natural, marketed million cubic feet	[r]209,383	[r]237,599	258,511	296,006	337,995
Natural gas liquids:[10]					
Ethane thousand 42-gallon barrels	961	695	[e]900	[e]1,000	NA
Propane do.	7,252	7,979	[e]8,160	[e]8,500	NA
Butane do.	8,116	8,734	[e]8,840	[e]9,100	NA
Condensate do.	39	41	[e]40	[e]50	NA
Total do.	16,368	17,449	17,940	18,650	18,172
Peat do.	4,449	6,433	6,424	7,000	[e]7,500
Petroleum:					
Crude do.	152,522	157,157	158,421	159,560	139,885
Refinery products:					
Gasoline:					
Aviation do.	297	333	352	428	730
Motor do.	79,960	86,875	86,957	88,183	88,885
Jet fuel do.	13,186	14,001	13,932	14,586	14,040
Kerosine do.	2,066	2,069	1,635	1,654	1,891
Distillate fuel oil do.	51,891	55,702	57,011	59,010	53,257
Residual fuel oil do.	30,704	29,380	28,738	28,964	22,258
Lubricants do.	3,358	3,573	3,717	3,717	NA

See footnotes at end of table.

Table 1.—Australia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other:					
Refinery gas[11] thousand 42-gallon barrels	727	711	667	377	NA
Liquefied petroleum gas do	4,071	4,522	4,132	4,038	3,828
Solvents do	1,455	1,472	1,377	1,384	NA
Bitumen do	2,911	3,340	3,013	3,283	NA
Unspecified do	8,389	7,195	6,768	5,522	NA
Refinery fuel and losses do	16,467	16,525	18,103	20,633	NA
Total do	215,482	225,698	226,402	231,779	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Sept. 29, 1981.
[2]Exports (production not officially reported).
[3]Data are for years ending Nov. 30 of that stated for plants owned by The Broken Hill Pty. Co. Ltd.
[4]Revised to zero.
[5]Western Australia only. Metal content of nickel ore.
[6]Excludes production from Western Australia.
[7]Data are for years ending June 30 of that stated.
[8]Excludes production from Northern Territory and Australian Capital Territory.
[9]Excludes production from Northern Territory, Australian Capital Territory, and Western Australia.
[10]Excludes natural gasoline and liquefied petroleum gas, which are produced on Barrow Island, off the Western Australia coast. An unspecified portion of the liquefied petroleum gas extracted is apparently marketed locally, but this quantity is limited. The bulk of the liquefied petroleum gas and all of the natural gasoline is blended with crude oil and presumably is counted with crude oil from that area. Gross production of liquefied petroleum gas on Barrow Island was as follows, in thousand barrels: 1976—22, 1977—31, 1978—29, 1979-80—NA; and of natural gasoline: 1976—21, 1977—26, 1978—33, 1979-80—NA. Natural gas liquid output from several gasfields in Western Australia is excluded for similar reasons. Condensate production from these fields was as follows, in thousand barrels: 1976—25, 1977—23, 1978—19, 1979-80—NA.
[11]Residual fuel oil equivalent.

TRADE

Mineral commodities supplied 37% of Australia's total export value in 1980. Coal remained Australia's largest export commodity. The value of Australia's exports of coal was $1.9 billion in 1980. The value of iron ore and pellets was about $1.3 billion and the value of alumina was about $1.1 billion. These three commodities represented 24%, 16%, and 14%, respectively, of the 1980 mineral export value. Other large export earners were copper, lead, zinc, mineral sands, gold, nickel, and tin.

The value of mineral imports was about $1.7 billion in 1980; crude oil accounted for about 80% of the total value. The other principal import categories were phosphate rock, asbestos, and diamond.

Table 2.—Australia: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides, gross weight thousand tons	6,367	6,428	NA	NA.
Metal including alloys:				
Scrap	7,748	10,509	--	Japan 10,032; Pakistan 138.
Unwrought	75,921	81,111	--	Japan 50,607; China, mainland 11,868; Philippines 7,873.
Semimanufactures	3,793	10,265	2,967	New Zealand 1,972; Singapore 731; Republic of Korea 705.
Antimony ore and concentrate, gross weight	2,065	2,120	--	All to Belgium-Luxembourg.
Cadmium metal including alloys, all forms	567	823	429	New Caledonia 152; United Kingdom 112.

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
METALS —Continued				
Chromium:				
Chromite, gross weight	168	38	NA	NA.
Oxides and hydroxides	12	--		
Columbium, tantalum, niobium ore and concentrate, gross weight	166	138	51	Netherlands 58.
Copper:				
Ore and concentrate, gross weight	107,722	135,679	4,641	Japan 114,761; West Germany 11,443.
Matte	5,999	4,387	--	Namibia 2,376; Fiji 1,011; West Germany 1,000.
Copper-lead dross and speiss	5,677	5,129	4,796	Belgium-Luxembourg 333.
Metal including alloys:				
Scrap	386	383	--	Japan 163; United Kingdom 108; Taiwan 51.
Unwrought:				
Blister and cement	7,542	12,094	--	Belgium-Luxembourg 6,001; West Germany 3,126; Japan 1,976.
Refined, unalloyed	65,991	53,320	--	United Kingdom 16,667; Belgium-Luxembourg 10,600; France 8,910.
Alloys, including master alloys	104	358	69	Singapore 65; Thailand 63; New Zealand 42.
Semimanufactures:				
Unalloyed	21,670	27,970	923	New Zealand 10,169; Republic of Korea 3,335; Indonesia 1,975.
Alloyed	2,953	4,630	872	Hong Kong 1,473; Singapore 877; New Zealand 573.
Gold:				
Ore and concentrate value, thousands	$1,463	$14	NA	NA.
Waste and scrap do	NA	$3,006	--	United Kingdom $2,216; Hong Kong $649.
Metal including alloys:				
Bullion, refined and unrefined do	$49,353	$22	--	All to Hong Kong.
Other do	$2,522	$85,292	$668	Hong Kong $76,145.
Iron and steel:				
Ore and concentrate excluding roasted pyrite thousand tons	74,691	79,585	292	Japan 53,317; China, mainland 7,964; West Germany 5,879.
Roasted pyrite	18	--		
Metal:				
Scrap	481,805	596,747	NA	NA.
Pig iron, sponge iron, powder, shot	519,241	785,425	6,630	China, mainland 483,571; Japan 181,990; Romania 32,603.
Ferroalloys	39,103	43,605	18,809	Indonesia 5,558; Singapore 5,550; Japan 4,829.
Steel, primary forms thousand tons	1,604	1,248	NA	Republic of Korea 232; Philippines 200; Iran 182.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	325	331	--	China, mainland 128; Indonesia 36; Singapore 19.
Universals, plates, sheets do	551	590	50	New Zealand 143; China, mainland 68; Papua-New Guinea 17.
Hoop and strip do	31	33	--	New Zealand 14; Taiwan 7; China, mainland 4.
Rails and accessories do	6	31	--	Pakistan 18; New Zealand 10.
Wire do	12	23	1	New Zealand 6; Papua New Guinea 2.
Tubes, pipes, fittings do	58	92	3	NA.
Castings and forgings, rough do	2	3	1	Singapore 1.
Lead:				
Ore and concentrate, gross weight	171,997	87,231	17,776	Belgium-Luxembourg 24,766; France 21,034; Japan 10,670.
Slag and residue	2,588	18,262	--	Japan 6,686; Republic of South Africa 3,871; Netherlands 815.
Oxides and hydroxides	4,624	3,349	--	China, mainland 1,153; Malaysia 587; Indonesia 560.
Metal including alloys:				
Scrap	5,461	7,936	--	Taiwan 2,067; Malaysia 1,319.
Unwrought:				
Bullion	157,915	159,637	--	United Kingdom 136,432; Netherlands 11,419.

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
METALS —Continued				
Lead —Continued				
Metal including alloys —Continued				
Unwrought —Continued				
Refined	138,595	152,240	16,324	India 30,242; Italy 16,416; United Kingdom 15,262.
Other	8,762	10,401	--	Malaysia 3,872; New Zealand 1,448; Philippines 1,262.
Semimanufactures	1,118	2,635	--	Thailand 584; Singapore 425; Philippines 385.
Manganese ore and concentrate	436	424	--	New Zealand 423.
Nickel:				
Ore and concentrate value, thousands	r$8,986	$3,126	NA	NA.
Matte, speiss, similar materials do.	r$185,799	$143,983	NA	NA.
Metal including alloys:				
Waste and scrap do.	NA	$996	$80	United Kingdom $854.
Unwrought do.	r$29,195	$104,188	NA	NA.
Semimanufactures do.	r$19,767	$10,918	NA	NA.
Platinum-group metals including alloys, unwrought and partly wrought[2] troy ounces	64,290	9,999	--	Hong Kong 3,962; New Zealand 2,536; Singapore 1,253.
Rare-earth metals: Monazite, gross weight	7,793	35,493	25,551	France 8,884.
Silver:				
Ore and concentrate[3] value, thousands	$2,673	$7,802	$33	United Kingdom $7,712.
Waste and sweepings[3] do.	NA	$1,539	--	United Kingdom $888; New Zealand $488.
Metal including alloys:				
Refined bullion do.	$16,360	$18,826	$9	United Kingdom $10,446; Japan $6,770.
Other do.	$2,634	$9,200	--	United Kingdom $2,268; Singapore $2,178.
Tin:				
Ore and concentrate, gross weight	20,672	18,027	--	Malaysia 17,741.
Oxides	9	NA	NA	NA.
Metal including alloys:				
Waste and scrap	3,624	940	2	Belgium-Luxembourg 891.
Unwrought	2,821	1,811	--	United Kingdom 1,002; Netherlands 410.
Semimanufactures	374	29	--	New Zealand 18.
Titanium ore and concentrate, gross weight:				
Ilmenite excluding beneficiated ilmenite	1,003,379	892,331	215,595	United Kingdom 186,903; France 123,574; Spain 94,091.
Leucoxene	12,091	10,644	4,200	United Kingdom 5,000; Japan 1,009.
Rutile	318,379	364,121	190,416	United Kingdom 46,529; Japan 28,355; Netherlands 23,460.
Tungsten ore and concentrate, gross weight:				
Scheelite	3,366	4,082	208	West Germany 2,277; U.S.S.R. 739; Sweden 506.
Wolframite	786	1,836	190	West Germany 1,234; Singapore 144; United Kingdom 120.
Uranium and thorium ores and concentrates	7,609	2,012	850	Canada 708; United Kingdom 379.
Vanadium ore and concentrate[4]	88	438	--	Taiwan 157; Indonesia 100; Argentina 100.
Zinc:				
Ore and concentrate, gross weight	417,745	485,726	15,710	Japan 250,091; Netherlands 62,491; Republic of Korea 36,877.
Oxides and hydroxides	323	606	--	Philippines 247; Taiwan 144; Singapore 113.
Slag and residue	5,485	3,476	--	Taiwan 2,199; Republic of South Africa 612.
Metal including alloys:				
Waste and scrap	NA	70	--	Philippines 34.
Unwrought	184,315	194,424	32,425	Taiwan 31,680; Indonesia 24,497; Thailand 19,802.
Semimanufactures	3,717	15,016	--	Indonesia 4,736; New Zealand 3,090; Thailand 2,485.
Zirconium ore and concentrate, gross weight	361,549	450,767	64,465	Japan 160,349; Italy 67,459; Canada 27,145.

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates value, thousands	$137,534	$139,743	NA	NA.
Waste and scrap containing nonferrous metals	2,388	3,685	--	United Kingdom 3,033; Belgium-Luxembourg 305.
Oxides, hydroxides, peroxides value, thousands	r$10,843	$12,907	$2,610	Taiwan $2,042; Indonesia $1,488; New Zealand $1,261.
Metals including alloys, all forms: Tungsten, molybdenum, tantalum, magnesium	31	201	31	West Germany 55; United Kingdom 53; Netherlands 33.
Unspecified value, thousands	$169	$411	$75	Singapore $246; New Zealand $53.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc do	$65	$1,840	--	Thailand $1,812.
Artificial corundum do	$388	NA	NA	NA.
Dust and powder of precious and semi-precious stones do	r$25	$43	--	New Zealand $18; Hong Kong $16.
Grinding and polishing wheels and stones do	r$391	$1,014	$22	Papua New Guinea $405; Thailand $174.
Asbestos, crude	32,145	38,348	--	Thailand 7,309; India 7,301; Singapore 4,714.
Barite and witherite	1,467	1,002	--	New Zealand 665; Republic of South Africa 160.
Cement	6,914	103,726	32,847	Singapore 44,275; Papua New Guinea 10,727.
Clays and clay products:				
Crude	12,044	9,687	--	United Kingdom 3,395; Japan 2,009; Indonesia 1,967.
Products:				
Refractory including nonclay brick:				
Brick	2,759	7,585	--	New Zealand 3,651; New Caledonia 1,539; Indonesia 831.
Other value, thousands	r$1,452	$1,170	--	New Zealand $488; New Caledonia $140; Singapore $135.
Nonrefractory do	r$395	$831	--	Malaysia $361; Singapore $89; Papua New Guinea $89.
Diamond:				
Gem, not set or strung carats	13,597	16,415	338	Belgium-Luxembourg 4,595; Hong Kong 4,276; Israel 2,312.
Industrial do	297,018	233,684	3,747	Ireland 153,747; Hong Kong 35,000; Philippines 13,008.
Diatomite and other infusorial earth value, thousands	NA	$2	NA	NA.
Fertilizer materials:				
Crude	298,478	121,122	--	Japan 64,000; Republic of Korea 29,400; Malaysia 19,200.
Manufactured:				
Nitrogenous	7,228	8,239	--	New Zealand 5,908; Papua New Guinea 1,645.
Phosphatic	249	2,105	--	Papua New Guinea 1,596; Malaysia 285.
Potassic	33	35	NA	NA.
Other including mixed	787	3,132	--	New Zealand 1,741; Papua New Guinea 1,278.
Ammonia value, thousands	r$195	$471	--	New Zealand $237; Malaysia $210.
Graphite, natural	NA	17	--	New Zealand 10.
Gypsum and plasters	193,750	263,567	--	New Zealand 73,712; Indonesia 60,397; Singapore 32,793.
Lime	37	1,031	--	Papua New Guinea 969.
Magnesite, other magnesium carbonate, magnesium oxide	3,443	3,598	427	New Zealand 2,596; Philippines 270.
Mica, worked including agglomerated splittings value, thousands	r$102	$65	--	New Zealand $43.
Pigments, mineral:				
Natural, crude	53	--		
Iron oxides, processed	28	192	--	New Zealand 125; Indonesia 29.

See footnotes at end of table.

Table 2.—Australia: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
NONMETALS —Continued				
Precious and semiprecious stones except diamond:				
Opal ____ value, thousands	$23,104	$32,417	$4,858	Hong Kong $14,093; Japan $7,285.
Sapphire ____ do.	$7,602	$16,059	$206	Thailand $11,986; Hong Kong $2,083.
Other ____ do.	$2,155	$2,878	$450	Hong Kong $658; Singapore $419.
Pyrite, gross weight	261	347	--	New Zealand 281.
Salt and brines ____ thousand tons	4,154	4,512	--	Japan 3,297.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	301	98	--	Saudi Arabia 46; Western Samoa 22.
Caustic potash, sodic and potassic peroxides	3	18	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	193	1,086	--	Italy 916; Japan 153.
Worked ____ value, thousands	$138	$32	--	Japan $22.
Dolomite, chiefly refractory grade	20,037	20,119	--	Taiwan 19,957.
Gravel and crushed rock	409	936	NA	Brazil 299; Hong Kong 177; Argentina 150.
Limestone except dimension	NA	11,351	--	Singapore 11,192.
Sand, silica	467,073	657,887	59,997	Japan 471,441; Republic of Korea 102,397.
Sulfur: Sulfuric acid, oleum	120	1,428	--	New Zealand 991; Papua New Guinea 207.
Talc, steatite, soapstone, pyrophyllite	93,104	118,047	--	Japan 97,722; Netherlands 12,059.
Other:				
Crude:				
Quartz, mica, feldspar, fluorspar, cryolite	81	152	--	New Zealand 122.
Unspecified value, thousands	$598	$37,834	$2,251	Japan $16,704; West Germany $7,523; United Kingdom $5,650.
Oxides, hydroxides, peroxides of strontium and barium	8	4	NA	NA.
Slag, dross, similar waste, not metal-bearing ____ value, thousands	NA	$24	--	Malaysia $14.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals ____ do.	r$5,359	$11,488	--	Canada $4,552; Taiwan $1,395; New Zealand $1,358.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	42,799	39,950	--	Thailand 11,517; Indonesia 11,259; New Zealand 6,330.
Coal including briquets:				
Bituminous coal and briquets thousand tons	45,163	39,103	523	Japan 25,739; France 1,958; United Kingdom 1,807.
Lignite, peat and briquets thereof	29,049	52,474	--	Japan 27,314; Norway 12,000
Coke and semicoke	149,435	147,397	--	Philippines 102,649; Greece 28,892.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	1,324	2,330	463	New Zealand 1,751.
Refinery products:				
Gasoline ____ do.	2,114	2,475	--	New Zealand 1,709; Fiji 384.
Jet fuel ____ do.	r1,833	1,913	--	New Zealand 1,271.
Kerosine ____ do.	r705	530	--	New Zealand 399; Fiji 89.
Distillate fuel oil ____ do.	4,685	5,424	--	New Zealand 1,421; Fiji 798; Japan 604.
Residual fuel oil ____ do.	1,460	1,593	1,053	Panama 384.
Lubricants ____ do.	1,742	1,616	568	New Zealand 252; Singapore 151; Malaysia 143.
Unspecified ____ do.	r20	[5]745	730	NA.
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals value, thousands	r$8,232	$17,156	--	New Zealand $10,674; Singapore $3,489.

rRevised. NA Not available.
[1]Data are for fiscal years beginning July 1.
[2]Ore and concentrate waste and sweepings are included in those of silver.
[3]May include platinum-group metals.
[4]May include molybdenum.
[5]Excludes an unreported quantity valued at $31,390.

Table 3.—Australia: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	11,426	15,634	--	Guyana 8,230; China, mainland 7,358.
Oxides and hydroxides	4,626	8,610	1,845	Japan 4,877; United Kingdom 546; Austria 455.
Metal including alloys:				
Scrap	1,369	1,223	2	New Zealand 1,168; United Kingdom 34.
Unwrought	178	3,392	53	New Zealand 2,925; United Kingdom 385.
Semimanufactures	4,150	5,258	2,520	United Kingdom 819; New Zealand 667.
Antimony:				
Oxides and hydroxides	186	212	6	United Kingdom 144; France 45.
Metal including alloys, all forms	117	29	--	Mainly from China, mainland.
Arsenic trioxide and pentoxide, acid	908	744	--	France 607; Belgium-Luxembourg 71; China, mainland 48.
Beryllium metal including alloys, all forms value	$43,605	$7,848	NA	NA.
Bismuth metal including alloys, all forms	18	25	--	Japan 9; United Kingdom 9.
Chromium:				
Chromite	13,466	10,746	--	Philippines 8,725; Republic of South Africa 2,020.
Oxides, hydroxides, trioxides	737	889	155	U.S.S.R. 462; West Germany 228.
Metal including alloys, all forms	26	53	--	Mainly from Japan.
Cobalt:				
Oxides and hydroxides	7	13	4	Belgium-Luxembourg 8.
Metal including alloys, all forms	48	44	8	United Kingdom 18; Belgium-Luxembourg 9.
Copper:				
Ore and concentrate	355	(2)	--	NA.
Matte	3	--		
Sulfate	197	162	--	New Zealand 109; United Kingdom 52.
Metal including alloys:				
Scrap:				
Unalloyed	329	500	--	New Zealand 353; Papua New Guinea 95.
Alloyed	458	662	--	New Zealand 354; Papua New Guinea 206.
Unwrought	204	4,576	4	Belgium-Luxembourg 4,001.
Semimanufactures value, thousands	$12,873	$18,874	$2,425	United Kingdom $4,828; West Germany $1,586; New Zealand $952.
Gold:				
Ore and concentrate do	$29	$20	--	All from Fiji.
Metal:				
Crude bullion, Au content troy ounces	44,262	19,110	--	Fiji 17,102; Papua New Guinea 1,994.
Refined bullion do	7,319	42	NA	NA.
Other including alloys: Unwrought, partly wrought, waste, sweepings value, thousand	$2,095	$1,344	--	Malaysia $646; Papua New Guinea $574.
Iron and steel:				
Ore and concentrate including roasted pyrite	27,590	42,783	91	Canada 40,981; Philippines 1,500.
Metal:				
Scrap	659	1,049	--	Papua New Guinea 434; West Germany 247; Belgium-Luxembourg 214.
Sponge iron, powder, shot	6,620	8,786	298	Sweden 3,823; Japan 1,656.
Spiegeleisen	60	60	--	All from West Germany.
Ferroalloys:				
Powder:				
Ferromanganese	191	319	--	Japan 255; Republic of South Africa 26.
Other	84	157	19	France 51; Japan 47.
Shot:				
Ferrochromium	12,967	10,178	9	Republic of South Africa 8,451; Brazil 1,500.
Ferromanganese	966	7,314	204	Japan 4,203; Republic of South Africa 2,726.
Ferromolybdenum	201	133	119	Chile 8.
Ferrosilicon	5,188	5,620	2,533	Republic of South Africa 1,891; France 360; Canada 257.
Ferronickel	19	--		
Other	1,723	2,579	123	United Kingdom 1,122; Brazil 531; Spain 309.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Steel, primary forms	672	16,014	--	Republic of Korea 15,300.
Semimanufactures:				
Bars, rods, angles, shapes, sections	65,521	55,054	1,197	Japan 40,367; United Kingdom 4,794.
Universals, plates, sheets	311,292	244,131	1,440	Japan 161,780; Republic of Korea 35,222.
Hoop and strip	22,224	19,860	1,087	Japan 12,388; United Kingdom 3,513.
Rails and accessories	1,618	891	101	Japan 623.
Wire	10,970	11,153	598	Japan 7,632; United Kingdom 982.
Tubes, pipes, fittings[3]	118,850	131,272	5,694	Japan 88,801; United Kingdom 6,439.
Castings and forgings, rough value, thousands	$765	$348	--	Taiwan $223; United Kingdom $83.
Lead:				
Oxides	68	177	13	Mexico 108.
Metal including alloys:				
Scrap	202	285	--	Fiji 118; New Zealand 77; Papua New Guinea 45.
Unwrought and semimanufactures	254	10,037	--	West Germany 10,002.
Magnesium metal including alloys:				
Waste and scrap	385	167	126	Norway 41.
Unwrought and semimanufactures	1,818	2,596	611	Norway 1,746.
Manganese:				
Ore and concentrate:				
Battery-grade	2,657	1,500	NA	NA.
Metallurgical-grade	--	85	85	
Oxides	1,456	1,245	222	Japan 1,005.
Metal including alloys, all forms	899	939	--	Republic of South Africa 448; Japan 425.
Mercury 76-pound flasks	1,389	2,089	--	China, mainland 1,326; Spain 550.
Molybdenum:				
Ore and concentrate	314	334	52	Canada 247; West Germany 35.
Metal including alloys:				
Wire	5	11	9	United Kingdom 1.
Other value, thousands	$296	$18	NA	NA.
Nickel:				
Oxides kilograms	136,792	270	NA	NA.
Matte, speiss, similar materials	3,465	1,575	3	Canada 1,572.
Metal including alloys:				
Scrap	5	--		
Unwrought	2,352	1,642	3	Canada 1,629.
Semimanufactures	1,296	3,970	370	Japan 2,016; United Kingdom 1,250.
Platinum-group metals including alloys, unwrought and partly wrought[4] troy ounces	807,767	112,534	13,864	United Kingdom 85,673; West Germany 4,676; Switzerland 4,185.
Silicon metal	2,006	3,573	--	Republic of South Africa 2,474; Canada 526; Italy 184.
Silver:				
Ore and concentrate[5] kilograms	1	--		
Waste and sweepings[5] value, thousands	$753	$142	--	Hong Kong $84; New Zealand $43.
Metal including alloys, unwrought and partly wrought troy ounces	100,083	108,862	23,309	United Kingdom 32,472; Switzerland 3,344.
Tin:				
Oxides	5	12	--	Mainly from United Kingdom.
Metal including alloys:				
Scrap	19	24	--	New Zealand 18.
Unwrought	216	204	--	Malaysia 154; Thailand 50.
Semimanufactures	16	17	2	United Kingdom 14.
Tungsten metal including alloys, all forms	6	7	2	West Germany 1; Canada 1.
Zinc:				
Ore and concentrate	13	1	NA	NA.
Oxides and peroxides	981	1,180	373	Canada 343; West Germany 321.
Metal including alloys, all forms	99	307	24	United Kingdom 123; New Zealand 91.
Other:				
Ores and concentrates:				
Of niobium, tantalum, titanium, vanadium, zirconium	38	45	(2)	United Kingdom 35; Japan 10.
Of base metals	2,219	1,874	305	Philippines 1,500.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Ash and residue containing nonferrous metals	306	1,066	24	New Zealand 545; United Kingdom 234; India 130.
Oxides, hydroxides, peroxides	836	739	192	Japan 155; China, mainland 71; West Germany 69.
Metals:				
Metalloids	2,299	2,506	308	Canada 1,295; United Kingdom 651; Republic of South Africa 207.
Alkali, alkaline-earth, rare-earth metals	80	116	17	West Germany 46; United Kingdom 28.
Base metals including alloys, all forms	70	138	47	Republic of South Africa 28; New Zealand 26; United Kingdom 17.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	630	666	234	New Zealand 204; Greece 149.
Artificial corundum	2,602	2,872	395	United Kingdom 734; West Germany 671; France 634.
Dust and powder of precious and semiprecious stones except diamond kilograms	--	298	NA	Ireland 5.
Grinding and polishing wheels and stones	1,124	1,372	88	United Kingdom 292; Japan 249; Netherlands 242.
Asbestos, crude	55,265	29,442	900	Canada 20,014; Republic of South Africa 8,305.
Barite and witherite	875	620	--	China, mainland 601.
Boron materials:				
Crude natural borates	6	19	NA	NA.
Oxide and acid	3,061	2,757	2,667	U.S.S.R. 86.
Cement	[6]28,729	28,582	1,305	Japan 13,268; United Kingdom 5,500.
Chalk	5,091	3,755	2	United Kingdom 2,951; France 567; New Zealand 234.
Clays and clays products:				
Crude:				
Bentonite	19,403	44,306	38,894	New Zealand 5,160; Singapore 191.
Fire clay and ball clay	1,875	1,409	310	NA.
Andalusite, mullite, dinas earth, kyanite, sillimanite	539	2,544	2,460	Republic of South Africa 57.
Kaolin (china clay)	11,075	5,640	5,121	United Kingdom 367.
Chamotte	4,223	3,583	--	Republic of South Africa 3,398; United Kingdom 157.
Other	24,985	38,391	33,602	Republic of South Africa 3,321.
Products:				
Refractory including nonclay brick[7]	31,362	23,238	777	Japan 12,149; United Kingdom 6,066; Austria 1,541.
Nonrefractory value, thousands	$45,503	$43,632	$111	Italy $20,536; Japan $15,323.
Cryolite and chiolite	158	175	--	Denmark 137; Netherlands 38.
Diamond:				
Gem, not set or strung carats	80,990	63,606	1,163	Israel 21,039; India 18,314; Belgium-Luxembourg 12,149.
Industrial do	262,479	352,093	140,376	Ireland 92,836; Republic of South Africa 67,679; United Kingdom 33,145.
Dust and powder do	571,346	868,783	430,464	Ireland 323,772; U.S.S.R. 53,150; Republic of South Africa 33,594.
Diatomite and other infusorial earth	6,619	7,041	7,011	NA.
Feldspar, leucite, nepheline	12,661	2,722	--	Canada 1,757; Norway 485; China, mainland 439.
Fertilizer materials:				
Crude:				
Nitrogenous	2,219	1,260	--	All from Belgium-Luxembourg.
Phosphatic thousand tons	1,610	2,380	80	Norway 1,221; Christmas Island 722; Gilbert Island 288.
Potassic	--	5	--	NA.
Manufactured:				
Nitrogenous	23,321	28,999	7,994	Qatar 8,874; Norway 8,747.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Manufactured —Continued				
Phosphatic	10,082	66,253	66,244	NA.
Potassic	161,897	174,032	67,320	Canada 104,603.
Other including mixed	24,995	5,263	366	West Germany 2,434; Netherlands 795; Belgium-Luxembourg 747.
Ammonia	$5,738	$6,727	NA	NA.
Fluorspar	26,132	33,532	--	China, mainland 19,924; Republic of South Africa 7,039; Thailand 6,465.
Graphite, natural	2,073	2,275	9	Sri Lanka 1,261; China, mainland 351; Republic of Korea 342.
Gypsum and plasters	11,745	1,969	170	Japan 970; United Kingdom 626.
Iodine	26	19	--	Japan 11; Indonesia 3.
Lime	$211	$55	--	France $25; Canada $17.
Magnesite	6,022	34,569	3,790	Japan 30,627.
Mica:				
Crude including splittings and waste	830	393	24	India 192; Republic of South Africa 131.
Worked including agglomerated splittings[8]	$365	$709	$168	West Germany $190; United Kingdom $111; Japan $104.
Pigments, mineral:				
Natural, crude	933	954	--	Austria 501; United Kingdom 210; West Germany 130.
Iron oxides, processed	8,563	8,414	512	West Germany 6,770; United Kingdom 403.
Precious and semiprecious stones except diamond:				
Natural	$7,817	$9,209	$243	Australia $2,122; Thailand $1,765; Hong Kong $1,145.
Manufactured	$464	$907	$53	Austria $283; West Germany $223; Switzerland $162.
Salt	30,059	20,007	222	Mexico 12,220; United Kingdom 4,199; New Zealand 2,635.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	$64,480	$57,487	NA	NA.
Caustic potash and sodic and potassic peroxides	2,406	2,739	338	Japan 1,070; United Kingdom 598; India 460.
Soda ash	NA	134	129	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	1,923	2,391	--	Italy 2,307.
Slate	1,634	2,973	--	Republic of South Africa 2,460; Italy 232; India 141.
Other	1,658	2,479	--	Republic of South Africa 1,503; Finland 353; India 202.
Worked	$2,508	$3,065	--	Italy $1,279; Taiwan $730.
Dolomite, chiefly refractory grade	39	85	--	New Zealand 26.
Gravel and crushed rock	916	67,457	--	Japan 66,000; Italy 1,194.
Limestone except dimension thousand tons	1,320	1,321	--	Japan 1,297; Philippines 24.
Quartz and quartzite	283	368	--	Sweden 173; West Germany 161.
Sand excluding metal-bearing	1,360	941	154	Sweden 486; West Germany 66.
Sulfur:				
Elemental:				
Other than colloidal	475,708	424,659	10,002	Canada 401,590; Iran 12,802.
Colloidal	137	136	1	Yugoslavia 62; West Germany 46.
Sulfuric acid, oleum	645	5,702	--	Japan 5,696.
Talc, steatite, soapstone, pyrophyllite	444	431	199	China, mainland 161.
Vermiculite	1,571	3,016	--	Republic of South Africa 2,826.
Other:				
Crude	441	915	152	New Zealand 290; United Kingdom 142; China, mainland 95.
Fluorine and bromine	NA	36	30	NA.
Slag, dross, similar waste, not metal-bearing:				
From iron and steel manufacture	23	88	--	New Zealand 78.
Unspecified	40	1,479	1,231	United Kingdom 247.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	7,332	5,157	5,041	Japan 52; Italy 33.

See footnotes at end of table.

Table 3.—Australia: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
NONMETALS —Continued				
Other —Continued				
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals value, thousands	$1,488	$1,129	$328	United Kingdom $471; Japan $118.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	946	1,299	844	Trinidad and Tobago 452.
Carbon black	789	732	364	Canada 120; West Germany 107; United Kingdom 102.
Coal, all grades, including briquets	12,910	15,380	586	Vietnam 10,285; Japan 781.
Coke and semicoke	3,373	19,951	1,026	New Zealand 8,234; Japan 7,989.
Peat including briquets and litter	21,076	12,591	--	West Germany 9,284; New Zealand 1,510.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	70,833	33,983	--	Kuwait 8,768; Iraq 8,290; United Arab Emirates 5,266.
Refinery products:				
Gasoline do	5,687	5,347	1	Italy 1,443; Singapore 1,078; Bahrain 1,026.
Kerosine and jet fuel do	282	1,327	44	Singapore 983; Bahrain 232.
Distillate fuel oil do	6,575	3,084	14	Singapore 2,658; Bahrain 343.
Residual fuel oil do	12,616	47,050	195	Saudi Arabia 27,224; Singapore 8,228; Kuwait 5,598.
Lubricants do	329	348	105	Netherlands Antilles 146; United Kingdom 46.
Other:				
Liquefied petroleum gas do	1	2	(2)	Japan 1.
Mineral jelly and wax do	56	59	19	China, mainland 19; Japan 10.
Bitumen, bituminous mixtures, other residues[9] do	31	27	1	Singapore 17.
Petroleum coke do	647	632	549	Canada 58.
Unspecified do	26	24	15	United Kingdom 6.
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals value, thousands	$6,524	$4,296	$3,646	Japan $493.

NA Not available.
[1]Data are for fiscal years beginning July 1.
[2]Less than 1/2 unit.
[3]Excludes quantities valued at $13,822,785 in 1977-78 and $17,139,377 in 1978-79.
[4]Ore and concentrate and waste sweepings of platinum-group metals are included with those of silver.
[5]Including those of platinum-group metals.
[6]Excludes quantity valued at $1,834,000.
[7]Excludes quantities valued at $242,000 in 1977-78 and $1,960,000 in 1978-79.
[8]May include some finished products.
[9]Excludes quantities valued at $14,000 in 1977-78 and $55,000 in 1978-79.

COMMODITY REVIEW

METALS

Aluminum, Alumina, and Bauxite.— Australia's bauxite and alumina production in 1980 declined for the second time in 17 years, but aluminum production continued the upward trend. The decline was attributed to industrial unrest at the mine of one major producer. For some years Australia has been the world's leading producer of bauxite from mines located at Weipa, Gove, Northern Territory, and the Darling Range. Production of alumina, however, decreased slightly in 1980 as a result of labor disputes at Pinjarra, Western Australia. Slight increases in output by Queensland Alumina Ltd. at Gladstone and by Nabalco Pty. at Gove, failed to offset the decline in Western Australia. Expanded smelter capacity by Alcan Australia Ltd. at Kurri Kurri, New South Wales, and Alcoa of Australia Ltd.'s smelter at Point Henry, Victoria, resulted

in a record output of primary aluminum in 1980.

At Weipa, on Cape York Peninsula, Comalco Pty. Ltd. produced about 15% of the Western World's total bauxite output. At Comalco, which is owned 45% by Conzinc Riotinto of Australia Ltd., 45% by Kaiser Aluminum and Chemical Corp., and 10% by the Australian public, output was slightly above that of 1979. Both production of bauxite and shipments from Weipa in 1979 were below the level of 1980, owing to an industrial dispute that restricted operations at the docks. In 1980, the company shipped about 9 million tons of bauxite to international markets, principally Japan and Europe. The largest single outlet was the Gladstone alumina refinery operated by Queensland Alumina Ltd. (QAL). Comalco supplied the total bauxite demand for QAL, which in 1980 totaled about 5.5 million tons. All of Alcoa's bauxite output was converted to alumina at nearby refineries located at Pinjarra and Kwinana, which have a combined annual capacity of 3.4 million tons. Roughly half of Nabalco Pty. Ltd.'s bauxite was exported. The remainder was refined to alumina in an adjacent refinery at Gove, which has an annual capacity slightly in excess of 1 million tons.

Australia's three aluminum smelters operated at near capacity levels throughout 1980, and production increased during the year. Production of primary aluminum by Alcan and Alcoa was appreciably higher than that of 1979. This increase resulted from new potlines commissioned in 1979-80 by both companies. The annual rated capacities of the three plants were Comalco at Bell Bay, 112,000 tons; Alcoa of Australia Ltd. at Point Henry, 165,000 tons; and Alcan at Kurri Kurri, 68,000 tons.

Prospects for Australia to occupy a more prominent position in the world aluminum smelting industry continued to improve. Higher prices for crude petroleum have made some oil-fired power stations uneconomic as sources of energy for aluminum production. As a result, Australia's extensive coal resources were recognized as having valuable potential for thermal power generation. Consequently, a number of new aluminum smelting ventures, which would use power from coal-fired stations, were under consideration. Comalco's 180,000-ton-per-year plant at Gladstone proceeded on schedule. The project will cost $500 million and was scheduled to be onstream in mid-1982. Nabalco began a feasibility study for a smelter to use alumina from Gove. During July, Alumax Pty. Ltd. finalized land purchases for the site of its proposed smelter at Lochinvar in the Hunter Valley of New South Wales, Australia. The smelter is planned for commissioning in 1984, with an annual production capacity of 236,000 tons and a capital cost of $650 million. Alumax is controlled 50% by Alumax of the United States, 45% by Mitsubishi, and 5% by Nippon Steel. Alcoa began a feasibility study for a smelter, probably to be located in the Pinjarra-Wagerup-Bunbury District of Western Australia. Alcoa was considering a minimum economic capacity of 100,000 tons annually, which could be increased to 200,000 to 240,000 tons. The project will depend on the availability and cost of power, and involve ultimately an expenditure of around $900 million.

Apart from the smelter developments, Alcoa planned to build a $200 million, 200,000-ton-per-year alumina plant at Wagerup. Nabalco was modifying its Gove alumina plant to produce sandy alumina, for which contracts have already been obtained. The company has also formed a subsidiary to make a study of the feasibility of establishing a smelter in the immediate vicinity of the alumina plant.

Australia has very large resources of bauxite, and production from Comalco's Weipa deposit was a significant source of the Western World's requirements. The company's proved, probable, and possible ore reserves at the beginning of 1980 comprised 3 billion tons with a recoverable bauxite content of 2.5 billion tons. The grade of recoverable bauxite in the 599 million tons of proved reserves ranged from 53% to 56% alumina. The alumina content in the probable reserves was in the range of 48% to 56%.

Copper.—Although the Australian copper industry showed signs of improvement in 1980, output from the various sectors was mixed. While mine output and primary refinery output declined in 1980, primary smelter production increased. Mine production by Mount Isa Mines Ltd. (MIM) in Queensland, which accounts for about 75% of Australia's output, increased 6%. Higher production was also reported by Mount Lyell Mining and Railway Co. Ltd. in Tasmania; Mount Morgan Ltd. in Queensland; and Peko-Wallsend Ltd., Northern Territory.

Lower mine output was attributed to a decrease in the quantity and grade of ore

treated. The decline at refineries was attributed to modernization of facilities, at which time operations were reduced and production declined. Production at MIM's refinery at Townsville, Queensland, was interrupted by commissioning problems after the modernization of the tankhouse. The supply of concentrates to Electrolytic Refining and Smelting's refinery at Port Kembla, New South Wales, was reduced.

The Townsville copper refinery produced 120,500 tons of refined copper in 1980. Output was marginally lower to enable work associated with the $15 million tankhouse modernization program to be completed during the year. The refinery now receives unrefined copper from Mount Isa in the form of anodes. Conversion of blister copper to anodes in the Townsville refinery's reverberatory furnaces ceased in December 1979. Both furnaces were then closed down and dismantled. The anode shaft furnace, installed to treat anode scrap produced in the tankhouse, is fully operational and performing to design parameters.

Peko-Wallsend Ltd. was making plans to develop the Gecko Mine at Tennant Creek, Northern Territory. The mine is expected to begin production in early 1981, at a rate of 385,000 tons annually. Concentrate from this mine will be smelted in the modified Tennant Creek smelter, which was recommissioned in October 1980. Peko-Wallsend produced about 16,500 tons of copper concentrate as a byproduct of mining gold-bismuth ore at its Warrego Mine.

Although several old mines could be reopened in the early 1980's the most significant copper production may involve new developments, in particular, the Olympic Dam project in South Australia and the Benambra deposit in Victoria. Western Mining Corp. (WMC) continued diamond drilling at the Olympic Dam project near Roxby Downs, where about 15 vertical holes were completed during 1980. Several of these holes intersected an extensive zone of copper and uranium mineralization at about 350 meters below the surface, ranging between 10- and 250-meters thick, and with grades generally between 1.0% to 3.3% copper with some lead, zinc, and silver.

Output of the principal copper producers in recent years is summarized in the following tabulation:

Table 4.—Australia: Major copper production, by company

Company	Production (metric tons)[1]		
	1978	1979	1980
Mines:			
Mount Isa Mines Ltd	159,064	152,000	161,000
Mount Morgan Ltd	4,399	1,916	2,074
Cobar Mines Pty. Ltd	8,153	8,100	6,540
Mount Lyell Mining & Railway Co. Ltd	18,444	19,405	16,299
Electrolytic Zinc Co. of Australia Ltd. (EZ Co.)	1,585	1,625	3,120
Peko-Wallsend Ltd	3,334	4,330	8,172
Smelters:[2]			
Mount Isa Mines Ltd	147,430	152,400	142,000
Mount Morgan Ltd	4,920	5,800	4,200
Electrolytic Refining and Smelting Co. of Australia Ltd.[3]	15,721	17,100	17,500
Refineries:[4]			
Mount Isa Mines Ltd	139,943	141,800	120,500
Electrolytic Refining and Smelting Co. of Australia Ltd.[3]	13,221	13,140	13,300

[1]Metal content of ore.
[2]Primary blister copper.
[3]Treats concentrates from Cobar.
[4]Primary electrolytic copper.

Gold.—The increased gold price has stimulated resurgence in gold prospecting and the redevelopment of old mine workings. However, Australia's mine production of gold in 1980 was below that of 1979. An increase in output by Central Norseman Gold Corp. Ltd. and the start of production from several reopened mines failed to offset decreased production from the Telfer and Mount Charlotte Mines, in Western Australia, where ore grades were lower than a year ago. Also, ore grades were lower at Tennant Creek since Peko-Wallsend Ltd. shifted emphasis from gold to copper production.

The Telfer Mine in the Paterson Range in Western Australia operated throughout 1980. The open pit project owned by Newmont Pty. Ltd. and Broken Hill Pty. Ltd. Co. (BHP), mined about 4 million tons of ore, averaging 0.20 troy ounce of gold per ton in 1980. The ore was completely oxidized,

and the gold occurred as discrete particles of varying sizes but mostly as fine grain. The ore was partially free milling, and up to 40% of the gold was recoverable by a gravity process. The remainder was recovered by conventional cyanide leaching. The Telfer ranks as one of the most import gold producers in Australia.

Several old mines were reopened during the year, including Marvel Loch, Comet, and Haveluck in Western Australia, and Wattle Gully Gold Mines NL in Victoria. Kia Ora Gold Corp. NL began production from Marvel Loch in May, completed commissioning of a new cyanidation plant in July, and near the end of the year announced plans to double treatment capacity to 120,000 tons annually. Reserves at yearend were 347,000 tons of ore averaging 0.27 troy ounce per ton.

Kalgoorlie Mining Associates (Kalgoorlie Lake View Pty. Ltd.-Homestake Gold Ltd.) continued to operate the Mount Charlotte Mine at Kalgoorlie. The company began a rehabilitation program involving repairs and additions to the treatment plant at Fimiston and the installation of a crushing section. A decision to construct a new refractory ore treatment plant and a new shaft to 1,200 meters in depth at Mount Charlotte, which would increase mine capacity and ultimately replace the two existing shafts, was announced. Kalgoorlie Mining Associates expect to reduce the cost of producing gold by about $10 per ounce when the program is completed.

Central Norseman Gold Corp. Ltd., near Kalgoorlie, remained Australia's largest gold producer. The company produced approximately 125,000 troy ounces of gold in 1980. Development work continued on the No. 4 and No. 5 levels of the North Royal Mine, which was the main source of the gold production. The company was also producing gold from an open pit operation near the surface. Central Norseman encountered encouraging diamond-drill intersections in the program to extend its ore reserves at the mine. Ore reserves were estimated at 350,000 tons averaging 0.53 troy ounce of gold per ton in 1979.

The Warrego Mine (formerly a copper mine), operated by Peko-Wallsend Ltd., was the only producing gold mine at Tennant Creek. The Warrego copper concentrator was modified to treat Warrego gold ore. During the year, 202,500 tons of gold ore was treated, assaying 0.58 troy ounce per ton, with gold recoveries of 91.60%. In 1980, the company treated 390,300 tons of ore yielding 122,600 troy ounces of gold.

Wattle Gully near Castlemaine, Victoria, was reopened and an ore treatment plant was set up. The plant can treat 100,000 tons per year of ore and has a potential recovery of 85,000 troy ounces of gold. When the mine closed it was treating 200 tons of ore per week and producing grades of over 1 troy ounce per ton.

Newly won gold of domestic origin accounted for about 77% of Australia's total output in 1980, and refined gold produced from imported crude bullion and domestic and imported scrap accounted for the remainder. The Perth Mint, which refines crude gold bullion from gold mines in Western Australia and the Northern Territory as well as some bullion and scrap of overseas origin, was the largest domestic refinery of gold. Other gold refiners were Matthey Garrett Ltd. in Sydney and Engelhard Industries Ltd. in Melbourne. Most of the crude bullion from Fiji and Papua New Guinea was refined by Matthey Garrett. Base metal refineries were the only other sources of refined gold. In 1980, the Electrolytic Refining and Smelting Co. recovered about 12,000 troy ounces of gold from tankhouse sludges resulting from the electrolytic refining of copper at Port Kembla, and BHP recovered about 7,000 troy ounces from lead concentrates refined at Port Pirie, South Australia.

Iron and Steel.—Despite a decrease in world steel output in 1980, Australian production of iron ore rose because of increased Japanese purchases. Both domestic pig iron and crude steel production declined slightly, mainly as a result of industrial disputes. Discussions between Australian Pilbara iron ore producers and Japanese steel mills over proposals to open a new iron ore mine in the Pilbara region continued during 1980. Five areas are in competition as possible locations for the new mine.

As in recent years, most of the iron ore was produced in the Pilbara region in northwest Western Australia. In this area, five major companies produced about 90% of Australia's total iron ore output. They were Hamersley Iron Pty. Ltd. (Mount Tom Price and Paraburdoo); Mount Newman Iron Ore Pty. Ltd. (Whaleback Hill); Cliffs Western Australian Mining Co. Pty. Ltd. (Robe River); Goldsworthy Mining Ltd. (Mount Goldsworthy, Shay Gap, and Sunrise Hill); and Dampier Mining Co. Ltd. (Koolan Island and Yampi Sound). In addition to the Pilbara region, iron ore was

mined at Kollyanobbing by Dampier for use in the Kwinana blast furnace. In South Australia, BHP produced ore from the Middleback Ranges for steel plants in South Australia (Whyalla) and in New South Wales (Newcastle and Port Kembla). In a relatively small project, the iron ore at Savage River, Tasmania, was slurried and pumped to a pelletizing plant at Port Latta for shipment to Japan.

Production of iron ore by Hamersley in 1980 totaled a record level of 39.4 million tons compared with 32.8 million tons in 1979. This reflected a more stable industrial relations climate and efficient operation, particularly in the first half of the year. Four cyclones and resultant tropical rains caused the loss of 5 days of production at the mine in late 1980. The overall recovery of salable ore from material mined, at 59%, was equivalent to the rate achieved in 1979. Recovery will increase when the concentrator is brought up to full capacity. Output of salable ore from Mount Tom Price Mine was 24.5 million tons, compared with 19.5 million tons in 1979. Production included 10.8 million tons of high-grade fines. Total material mined was 41.6 million tons.

Salable ore production at Paraburdoo was 14.9 million tons, compared with 12.9 million tons in 1979. Production of high-grade fines was 7.4 million tons. Total material mined was 24.8 million tons. The operating performance of both mines and the crushing and screening plants was satisfactory. However, productivity for the year was adversely affected by longer haul distances in the mines. Development of the 4-West ore body at Paraburdoo continued during the year and production from this ore body commenced in December. Commissioning of the concentrator continued throughout 1980. Design expectations have not been reached on a continuing basis although the plant has operated at design levels over short periods.

In 1980, Mount Newman Mining Co. Pty. Ltd., being plagued with numerous production disruptions, produced about 28 million tons of iron ore. Sales totaled 32 million tons and the quantity of ore in stockpile totaled 2 million tons. Mount Newman's newly constructed heavy-media beneficiation plant was operational in 1980. The total cost of the plant and associated infrastructure was about $100 million. The plant recovers ore from contaminated waste material and provides Mount Newman with greater flexibility to increase capacity at a later date.

The principal Australian iron ore producers and their output in 1980 were as follows, in thousand tons:

Table 5.—Australia: Major iron ore production, by company

Company	Location	Products	Output	
			1979	1980
Hamersley Iron Pty. Ltd	South Australia	Lump and pellets	32,794	38,900
Mount Newman Mining Co. Pty. Ltd	Western Australia	Lump	35,000	27,300
Broken Hill Pty. Co. Ltd	South Australia	Lump and pellets	4,000	4,528
Do	Western Australia	Lump	2,000	2,000
Goldsworthy Mining Ltd	do	do	1,500	5,400

Australian reserves of iron ore were estimated at 35 billion tons, consisting of 25 billion tons of hematite, with 54% or more iron content, and 10 billion tons of limonite, with 50% or more iron content. Most of Australia's reserves occur in the Pilbara region, which accounted for over 90% of production in 1980. New mines in the region are being planned since iron ore prices have risen. Australian iron ore exporters and Japanese steelmakers concluded negotiations early in the year on prices of iron ore for delivery to Japan from April 1980. Prices of both lump and fines for delivery by major producers were increased by an average of about 20% above 1979 prices.

BHP remained the only steel producer in Australia, with plants at Newcastle and Port Kembla in New South Wales, Whyalla in South Australia, and Kwinana in Western Australia. Production of raw steel in 1980 totaled 7.8 million tons compared with 7.5 million tons in 1979. It is estimated that 715,000 tons of raw steel output was lost during the year because of strikes, including 522,000 tons in the second half of the year. Total capacity was about 9 million tons per year. Despite idle capacity, the company was expanding capacity to follow estimated future market requirements. Major measures taken to meet changing customer requirements at Newcastle in 1980 included the commissioning of leaded steel manufacturing facilities at Newcastle.

Projects still in progress in 1980 included the No. 5 coke ovens battery and modifications to the coal cleaning plant and steelmaking shop. At Port Kembla, work on the continuous slab caster with vacuum degasser and modifications to the No. 5 blast furnace were in progress during 1980. These installations represent large investments in the steel industry and in each case provide the benefits of the latest technology, which should result in quality improvements. Work was also continuing on modifications of the basic oxygen steelmaking plant. At Whyalla, work was continuing on the construction of the coke oven extensions and the installation of a waste-heat recuperator on the pellet plant.

BHP announced in September that it was proceeding with plans for the establishment of a small steel mill at Geelong, Victoria. Detailed engineering studies have been authorized and negotiations with Government officials were proceeding. A steel mill with a capacity of 200,000 tons annually was planned, and will comprise an electric arc furnace to treat scrap available in Victoria. The plant will include a continuous caster to produce billets suitable for rolling in the existing Geelong rodmill, which currently receives its billets for rolling from the Whyalla steelworks. The rodmill, which has a production capacity of 220,000 tons annually, produces feed for the nearby plant of Australian Wire Industries, which produces about one-third of Australia's wire products.

Conzinc Riotinto of Australia and Korf Stahl AG of the Federal Republic of Germany were also studying the feasibility of establishing a 200,000-ton steel mill at Geelong. The mill would have two electric furnaces and use scrap metal as raw material.

Lead and Zinc.—In 1980, mine production of lead was 4% lower than in the previous year. Both Broken Hill and Mount Isa recorded lower output in 1980 owing to mining of lower grade ores. Production from the Tasmanian west coast mines was adversely affected by a prolonged industrial stoppage in the final quarter of the year. The sole domestic producer of primary refined lead, Broken Hill Associated Smelters (BHAS) at Port Pirie, operated at a reduced capacity throughout the second half of the year.

Mine production of zinc was 7% below the record output of 1979. Lower first quarter output from Broken Hill Mines, and a drop in final quarter production from Rosebery, as a result of a prolonged industrial stoppage, accounted for the decline. The three primary zinc refineries operated at near capacity throughout the year, producing slightly less refined zinc than in 1979. A worldwide shortage of concentrates resulted in a substantial increase in concentrate exports, which increased by over 40%. The increase came largely from the Broken Hill Mines of Australian Mining & Smelting Ltd. (AM&S) comprising mainly shipments to Japan. Exports of refined zinc were also higher than in 1979.

MIM was Australia's largest single producer of lead and zinc. About 2.5 million tons of lead-zinc ore was mined in 1980 containing 6.8% lead and 5.7% zinc. Mining was concentrated between the 13 level (670 meters) and the 15 level (730 meters). The Mount Isa mining methods of cut and fill and open stoping were modified to achieve greater ore recovery and better utilization of workers and equipment. Drilling of the lead-zinc mineralized area continued in the northern part of the Mount Isa Mine throughout 1980 and some drilling was done in the foot-wall region. The drilling in the latter area was quite deep, about 1,100 meters below the surface. As a result of the drilling, over 1 million tons of ore were added to the zinc and lead reserves.

Modernization of the flotation section of the lead-zinc concentrator was well advanced with more than half of the new flotation cells of the single circuit installed at yearend. The desired levels of metallurgical recovery were achieved by the end of 1980.

Results of the feasibility study on the McArthur River zinc-lead deposit was presented to the Northern Territory Government in early 1980. The report indicated that development of the large mineralized area was not feasible under present economic conditions using presently known technology. Feasibility studies commenced on the Lady Loretta lead-zinc project, north of Mount Isa, held by agreement with Triako Mines NL These included metallurgical and rock mechanic studies.

In 1980, mine output by AM&S and two subsidiaries, Zinc Corp. Ltd., and New Broken Hill Consolidated Ltd. (NBHC), decreased from the 1979 level. The lower output was attributed to lower ore grade mined, and labor problems, which resulted in one work stoppage. Some new mining equipment was introduced in 1980. The successful commissioning of an additional large ball-

mill in the NBHC grinding circuit has overcome the problems resulting from the treatment of large quantities of hard, low-grade ore. This has enabled plant capacity to be maintained and metallurgical performance to be improved. Installation of the new crushing and screening plant at NBHC proceeded on schedule. The commissioning during January 1980 completed the first stage of the 3-year program to extend mine life by expansion of production while lowering the average grade of the ore mined.

A consortium, consisting of Conzinc Riotinto of Australia, St. Joe Minerals Corp., and Phelps Dodge Corp. of the United States, formally inaugurated the Woodlawn, New South Wales, mine project in December 1978. Following the commissioning, difficulty was experienced in obtaining satisfactory grades and recoveries in concentrate production from the complex ore body. Major deficiencies in plant design specifications complicated the task of achieving metallurgical improvements. A program of capital expenditure was initiated during 1979 to correct the plant deficiencies. Although this program continued throughout 1980, substantial improvements were apparent and steadier plant operating conditions were achieved. When operating at capacity, the mill would produce about 120,000 tons of zinc concentrates, 40,000 tons of lead concentrates, and 35,000 tons of copper concentrates annually. Output would be divided among the three joint venture partners, each of which would arrange its own sales. Diamond drilling in 1979 revealed ore reserves of 10 million tons, averaging 12% zinc, 4.5% lead, 1.8% copper, and 1.8 troy ounces of silver per ton.

The BHAS refinery operated below capacity in 1980 and primary lead production declined 7%. Operations at Port Pirie benefited from recent substantial expenditure. The tall stack and debismuthizing plant were the major projects undertaken. The debismuthizing plant was commissioned in June 1980 and will allow BHAS to produce an increased quantity of 99.99% purity lead. In late 1980, production of refined lead was augmented by treatment at Port Pirie of lead bullion from the Sulphide Corp. In addition, the new sinter breaker installed allowed the sinter plant to operate at a high level of efficiency.

EZ Industries Ltd. operated two mines, Rosebery and Hercules, both located in Tasmania. These are zinc-lead-copper deposits in association with gold, silver, and pyrite. The combined output of ore mined totaled about 653,400 tons in 1980, slightly less than that of 1979. The small increase at the Hercules Mine was insufficient to offset the decline at the Rosebery Mine, where more than 85% of the total ore was produced. The average grade of ore production from all mines was 11.8% zinc, 3.7% lead, and 4.3 ounces of silver per ton. Products of the concentrating mill were zinc, lead, copper, silver, gold, and pyrite concentrates, which were railed to the Port of Burnie.

The principal lead and zinc companies and the quantities produced during 1978-80 were as follows:

Table 6.—Australia: Lead-zinc production, by company

(Metric tons)

Company	1978		1979		1980	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
North Broken Hill Ltd	51,080	38,685	52,000	39,400	52,877	39,442
Zinc Corp. Ltd	79,400	61,000	80,000	63,000	86,240	56,700
New Broken Hill Consolidated Ltd	61,600	121,000	64,000	127,000	78,240	137,200
Mount Isa Mines Ltd	127,600	105,540	130,000	109,000	131,390	101,027
Electrolytic Zinc Co. of Australasia Ltd. (Read-Rosebery).	21,500	70,850	22,300	69,700	20,459	70,341

Manganese Ore.—The Groote Eylandt open pit manganese mine, located on an island in the Gulf of Carpentaria, accounted for virtually all of Australia's manganese production. The mine was operated by the Groote Eylandt Mining Co. Pty. Ltd. (GEMCO), a wholly owned subsidiary of BHP. The manganese ore occurs as a flat tabular-stratum, overlain by lateritic overburden up to 24 meters thick.

GEMCO produced 1.9 million tons of manganese ore from this operation, located in the Northern Territory, during 1980. Exports increased to 1.3 million tons in 1980, and shipments to most major markets increased. The largest tonnage (625,000

tons) went to Japan. About 430,000 tons was shipped to Europe, 130 tons to the United States, and 119 tons to the Republic of Korea. The remaining 600,000 tons was domestically consumed and processed by the Bell Bay plant, operated by Tasmanian Electro Metallurgical Co. Pty. Ltd., a subsidiary of BHP. The plant produced about 133,000 tons of ferroalloys, exceeding that of the previous year by 5%. Approximately 45,000 tons of ferroalloys were exported in 1980, compared with 35,000 tons in 1979.

Most ore for export was sold on a contract basis with prices being negotiated between buyer and seller. Price increases were negotiated during the year, but rapid escalation of freight rates and aggressive competition restricted profitability.

Currently, all of GEMCO's mine output is sold to the steel industry. However, BHP has built a pilot plant at its Newcastle research center to test the feasibility of producing manganese dioxide suitable for the battery industry. This could eventually provide an important second outlet for the company's product.

Australian manganese reserves were estimated at about 889 million tons in 1980, the main part of which was on Groote Eylandt. The remainder was located principally in the east Pilbara and Peak Hill regions of Western Australia and at Pernatty Lagoon in South Australia. Known deposits in the Northern Territory were subeconomic. Large secondary enrichment deposits along the outcrop of the Marra Mamba iron formation in the Pilbara region were being evaluated. These deposits were low in silica and consisted of about equal proportions of high-grade ore (40% manganese) and lower grade ores suitable for benificiation.

Nickel.—The decline in demand for nickel during 1980 caused some producers to close plants, and mine output declined by 5%. By reducing output, producers aimed to avoid an accumulation of surplus stocks and thereby assist price stability. Increased output at Agnew, Western Australia, by Agnew Nickel Co. Pty. Ltd., which rose by about 74%, and at Greenvale, Queensland by Queensland, Nickel Pty. Ltd., up 8%, was not sufficient to offset reduced output by WMC. Also, production at Spargoville, Western Australia, ceased in January when economic ore reserves became exhausted. Sulfide-based mines in Western Australia accounted for 60% of total production, with the remainder coming from the Greenvale lateritic mine in Queensland.

At the end of 1980, the Kambalda Mine at Kalgoorlie was still the principal nickel producer, accounting for more than 55% of the Australian production. The Greenvale operation in Queensland was the next largest. The Nepian, Spargoville, and Agnew Mines in Western Australia together produced less than 10% of the Australian total.

In 1980, WMC treated 1.3 million tons of ore from its Kambalda operations and produced 260,000 tons of concentrate containing 30,700 tons of nickel. The nickel mining and processing in Western Australia is WMC's main income-producing activity. The operations comprise nine underground mines and a concentrator at Kambalda, a nickel smelter at Kalgoorlie, and a nickel refinery at Kwinana. WMC also owns 50% of the Windarra nickel project consisting of mines and a concentrator at Windarra. Development of the Mount Windarra Mine continued with the aim of resuming production gradually as market conditions warrant.

In addition to operating the Kambalda and Scotia Mines, WMC owned the smelter at Kalgoorlie and the refinery at Kwinana. The company treated ore and concentrates from other mines on a toll basis and also smelted the half of Windarra production owned by the Shell Co. of Australia Ltd. Throughput for 1980 was 263,000 tons of nickel concentrate and 67,300 tons of nickel-bearing laterite. Expansion of the smelter capacity to 450,000 tons annually (concentrate) was completed.

This was the first full year of operation for Agnew Nickel Co. Pty. Ltd. Under agreement with WMC, concentrate was toll smelted to produce nickel matte, which was shipped to the United States under an agreement with Amax Nickel Inc. The transportation of concentrates to WMC's Kalgoorlie smelter was interrupted on many occasions by road closures owing to an abnormally high rainfall between February and June. The Agnew nickel deposit is one of the major sulfide nickel deposits of the world, and it is expected to become a substantial supplier of nickel. During the year, exploration was carried out into the mineralized zone below the depth originally planned. Exploration so far has been by surface drilling only. It was decided to extend the exploration shaft beyond the original 900 meters planned depth by 270 meters. This will enable the No. 2 and

No. 3 shoots of the deposit to be fully explored. When the work is completed it will be possible to make detailed plans for future production.

The Greenvale Mine in Queensland, owned equally by Metals Exploration Ltd. and Freeport of Australia Inc., was operated at about 75% of the designed capacity during 1980. The operation, which treats lateritic ore (acid leach), has overcome most of the early technical problems, but serious financial difficulties persist. Operations have generated a positive cashflow, but this has been totally inadequate to meet the cost of servicing the development loans. Some relief was obtained when the financiers agreed to a deferment of interest payments, but the financial viability of the whole project remains in doubt.

Some exploration work for nickel was in progress, mainly in Western Australia. Cliffs International Inc. reported it had intersected massive sulfides at Mount Keith, Western Australia, assaying between 1.7% and 6% nickel. The deposit averaged 3.5% nickel over a strike length of 1,200 meters and a depth between 100 and 450 meters.

Silver.—Most silver was produced as a byproduct of lead-zinc mining with gold and gold-copper mining making a contribution. Total silver production in 1980 was slightly below the 1979 output. More than 85% of the output came from mines in Mount Isa and Broken Hill. Silver was also produced as a byproduct of copper mining at Tennant Creek, Mount Morgan, Cobar, Woodlawn, and Mount Lyell.

MIM remained Australia's largest producer of silver. In 1980, about 2.5 million tons of lead-zinc ore, averaging 5.7 troy ounces of silver per ton, was treated to produce 14.6 million troy ounces of silver in concentrates. About 87% of the silver was recovered from lead concentrates and the remainder from zinc and copper concentrates. The lead concentrates were smelted to lead bullion at Mount Isa and exported to the company's lead refinery at Northfleet, United Kingdom, where the silver metal was recovered. Over 70% of the zinc concentrate was exported; the remainder was shipped to the zinc refinery at Risdon, Tasmania. Silver in copper and lead residues from the electrolytic tankhouse slimes from the Townsville copper refinery were either recovered by Electrolytic Refining and Smelting Co. or exported.

The Broken Hill area remained Australia's second largest source of silver in 1980. Production of silver from the lead-zinc concentrates in 1980 by several companies declined because of plant repairs and a lower overall grade of ore mined. The grade of ore treated contained 6.3 troy ounces per ton of silver, compared with 7.4 troy ounces per ton in 1979. Most of the silver produced at Broken Hill was contained in lead concentrates, which were treated at the BHAS smelting and refining plant at Port Pirie.

EZ Co. produced silver as a byproduct of copper-lead-zinc mining at Rosebery. In 1980, the company treated about 579,196 tons of Rosebery ore and 74,250 tons of Hercules ore. The average silver grade of the complex copper-lead-silver-gold ore treated was 3.7 troy ounces per ton, marginally lower than that of 1979. The ore yielded 132,000 tons of zinc concentrate containing 334,312 troy ounces of silver, 18,600 tons of lead concentrate containing 433,427 troy ounces of silver, and 24,000 tons of copper concentrate containing 1.4 million troy ounces of silver.

The introduction underground of electric powered loaders in stoping operations was successfully achieved late in the year. The 17-level decline operation using diesel-powered, rubber tired equipment commenced early in 1980 and progress was satisfactory. Mine development totaled 7,170 meters, compared with 6,967 meters for the previous year.

About 80% of all silver exported in 1980 was contained in lead bullion; lead, zinc, and copper concentrates; blister copper; and various slags, mattes, and residues. The remainder was exported as refined silver and mint bullion.

Principal producers of silver and output, in thousand troy ounces, during 1978-80, were as follows:

Table 7. Australia: Major silver production, by company

Company	1978	1979	1980
Electrolytic Zinc Co. of Australasia Ltd	2,481	2,470	2,168
Mount Isa Mines Ltd	14,720	14,496	14,592
New Broken Hill Consolidated Ltd	2,163	2,200	1,774
North Broken Hill Ltd	3,371	3,412	2,703
Zinc Corp. Ltd	1,155	1,300	1,650

Tin.—In 1980, mine production of tin-in-concentrates fell 10%, partly owing to industrial disputes at Renison, Tasmania. Production of primary refined tin was about 14% below the 1979 level. Although the strength of world tin prices in 1980 brought prosperity to Australian tin miners, the Australian Tin Producers' Association expressed concern that high prices and shortage of supplies could encourage technical developments to reduce the use of tin.

Renison Ltd. remained by far the largest tin producer in Australia, accounting for over 45% of the total production. Production in 1980 was affected by a number of industrial disputes and declined slightly. The mine is located at Renison Bell, Tasmania, and in 1980 the mill treated 551,105 tons of ore at an average head grade of 1.27% tin, with a recovery of 5,135 tons of tin in high-grade concentrate. The mill recovery of tin metal in concentrates was lifted from 71.2% to 73.6%. Renison completed construction associated with the expansion of milling capacity to 850,000 tons annually and began commissioning the plant. Following successful matte fuming trials on low-grade material, a detailed engineering study was begun to permit final assessment of the feasibility of a fuming plant. Renison's combined proved and probable ore reserves increased 10% to over 1.3 billion tons in 1980, but the grade dropped from 1.14% to 1.13% tin. The increase in tonnage and reduction in grade was largely a result of the addition of several million tons of lower grade ore added to the reserves.

Aberfoyle Ltd., Australia's second largest tin mining group, wholly owns and operates the Cleveland tin mine at Luina, Tasmania; the Ardlethan Mine, in New South Wales; and the Aberfoyle Mines at Rossarden and Storeys Creek, Tasmania. Although the total output by the Aberfoyle group declined about 14% in 1980, performance at individual mines varied. The Cleveland mill treated 367,900 tons of ore at at an average head grade of 0.47% tin and recovered 1,079 tons of tin in concentrate. The mill at Rossarden treated 49,311 tons of ore to produce 178 tons of tin in concentrate. At Ardlethan, the mill treated 552,000 tons of ore with a head grade of 0.51% tin, and recovered 1,714 tons of tin in concentrate.

Aberfoyle announced that a flotation plant would be installed at the Ardlethan Mine to increase metallurgical recovery. The plant was estimated to cost $3.4 million, and was to be in operation by March 1981.

In June 1980, Greenbushes Tin NL began to operate a small electric arc furnace (the second tin smelter to begin production in Australia) at its mine south of Perth, Western Australia, treating its concentrates and some from the Northern Territory. The smelter produces metallic tin and tantalum-bearing slags. In October, Greenbushes announced a discovery of a large tantalite resource with 21.8 million tons of ore assaying 0.11% tin, and 0.44% tantalum over a width of 14.7 meters. At present, this is augmented by 9.7 million tons of probable ore assaying 0.15% tin and 0.06% tantalum. In addition to production of primary refined tin, the new smelter produced about 150 tons of antimonial tin (99.5% tin).

Associated Tin Smelters Pty. Ltd. (ATS) operating at Alexandria, New South Wales, was the primary tin smelter. The smelter is owned equally by O.T. Lempriere & Co. Ltd, Consolidated Tin Smelters Pty. Ltd (Australia), and Australian Iron & Steel Pty. Ltd. Output of the smelter is limited by the low average grade of concentrates currently available, and can effectively produce about 7,000 tons of refined tin. In 1980, production by ATS was affected by industrial disputes and only 4,700 tons of primary refined tin was produced. Plants in Sydney, Wollongong, and Melbourne produced nearly 500 tons of secondary tin from tinplate scrap and tinplating wastes.

Titanium and Zirconium.—World demand for titanium and zirconium concentrates increased during the early half of 1980, following a protracted period of depressed demand, low prices, and erratic production. Australia's production of ilmenite, rutile, and zirconium exceeded the totals reported for 1979. While production in Western Australia decreased by about 10%, there was a marked recovery in production from operations on the east coast, particularly on North Stradbroke Island in Queensland. Production of salable-grade ilmenite concentrates continues to be confined mostly to operations in the Capel and Eneabba areas of Western Australia.

Weak demand for rare-earth oxides in the United States and Europe resulted in a decline in monazite concentrates. Virtually all of the rutile, zircon, and monazite output was exported, along with about 50% of the ilmenite. The remainder of the ilmenite was consumed within Australia for the production of titanium dioxide pigments and for the production of synthetic rutile. The principal destinations for the products were

Western Europe, Japan, and the United States.

A proposal to build a $100 million titanium metal plant in New South Wales was attracting interest from Australian and foreign companies. The proposal was strongly supported by the New South Wales Government. New South Wales has abundant rutile and cheap electricity.

Australia produces over 90% of the world's natural rutile, about 80% of the zircon, 70% of the monazite, and over 25% of the world's ilmenite. The industry was divided, generally, into three groups, the east coast producers of rutile and zircon, the west coast producers of ilmenite and zircon, and the new west coast producers of rutile, zircon, and ilmenite. On the east coast, four main groups (Associated Minerals Consolidated Ltd., Consolidated Rutile Ltd., Mineral Deposits Ltd., and Rutile & Zircon Mines Ltd.) accounted for most of the output. In 1980, Associated Minerals Consolidated Ltd. produced 100,900 tons of rutile, 174,380 tons of zircon, and 373,300 tons of ilmenite from plants in New South Wales and Queensland. Consolidated Rutile Ltd. produced about 30,000 tons of rutile in 1980, but has expanded plant facilities and expects to produce about 60,000 tons of rutile and 45,000 tons of zircon in 1981. Production by Mineral Deposits Ltd. totaled about 45,000 tons each for both rutile and zircon. Combined production by two plants operated by Rutile & Zircon Mines Ltd. totaled about 52,000 tons of zircon and 40,000 tons of rutile in 1980.

On the west coast, two major producers, Allied Eneabba Pty. Ltd. and Westralian Sands Ltd., supplied most of the output of mineral sands in 1980. Westralian Sands produced about 394,00 tons of ilmenite. The other main products were 36,000 tons of zircon, 15,000 tons of leucoxene, and 1,900 tons of monazite. Allied Eneabba's output consisted of 294,900 tons of ilmenite, 101,500 tons of zircon, 54,900 tons of rutile, and 9,000 tons of monazite. Small quantities of xenotime and garnet were also produced. Three other west coast companies (Western Titanium Ltd., Jennings Mining Ltd., and Cable Sands Ltd.) also produced titanium and zirconium concentrates during 1980. Western Titanium's main product was rutile, both Jennings Mining and Cable Sands produced rutile, ilmenite, and zircon.

One reason for the involvement of so few companies in Australia's mineral sands operations was attributed to the declining grade of ore reserves. The high-grade deposits have been mined out, and the mining companies have moved toward lower grade reserves that require larger and more expensive processing facilities. Also, large areas containing known reserves of rutile and zircon have been precluded from mining by being incorporated into new national parks. Australia's Bureau of Mineral Resources estimates that over 40% of identifiable economic resources of zircon and rutile on the east coast were unavailable for mining because of environmental considerations.

At yearend 1980, proven and probable reserves of heavy mineral sands totaled about 65 million tons in Western Australia, 20 million tons in Queensland, and 20 million tons in New South Wales. The content of heavy minerals ranged from 1% near Newcastle, to 80% at Eneabba. Most producers continued exploration in 1980, and most of the activity was in Western Australia.

NONMETALS

Diamond.—Diamonds have been discovered in the Kimberley region of Western Australia and a very intensive exploration and evaluation program has been undertaken. Sampling in 1980 produced about 48,000 carats. The major group in this activity is Ashton Joint Venture (AJV), consisting of CRA (56.8%), Ashton Mining NL (24.2%), A.O. PTY Ltd.(Australia) (4.9%), Tanaust Pty. Ltd. (9.1%), and Northern Mining Corp. NL (5.0%). During 1980, the AJV's activities were centered south on Lake Argyle. The Argyle prospect comprise a Kimberlite pipe, designated AK1 (surface area approximately 45 hectares), and two associated alluvial deposits, Upper Smoke Creek and Lower Smoke Creek, which extend 32 kilometers from the pipe to Lake Argyle. Preliminary sampling of the surface of pipe AK1 was completed and a program of more intensive bulk sampling was commenced near the end of the year. A drilling program to obtain an indication of grades at depth was also commenced. Sampling from pipe AK1 produced 11,560 carats from approximately 2,600 tons of material.

The Upper Smoke Creek alluvial deposit has estimated reserves of 500,000 cubic meters containing an average yield of 8 carats per cubic meter. Approximately 15% of the diamonds from the Upper Smoke Creek deposit have been assessed as gem quality, while the remainder were assessed as industrial quality. Sampling of the Lower

Smoke Creek alluvial deposits in 1980 resulted in a yield of 6,050 carats from approximately 20,000 tons of treated material. Preliminary feasibility studies are underway on various alternatives for the development of pipe AK1 and the Lower Smoke Creek deposit. A feasibility study for commercial production from the Upper Smoke Creek deposit has been completed. No decision to mine has yet been made. Initial investigations of potential markets for diamonds from AJV commenced during 1980 and will continue in 1981.

Phosphate Rock.—The Australian fertilizer industry consumes about 2.6 million tons of phosphate rock annually. Australia's first company to produce and export phosphate rock ceased operations in June 1978, but efforts are being made to resume operations. The decision by BH South Ltd. to close down the operation of its subsidiary, Queensland Phosphate Ltd. at Duchess, came after both the Australian Government and the Queensland State Government refused financial assistance to the company. When Duchess came into production in 1975, it was unable to establish long-term export sales contracts so essential to its economic viability, and it consistently operated well below its design capacity of 2 million tons annually. BH South became a subsidiary of WMC in late 1979, and the Duchess phosphate project was reviewed. Laboratory-scale work towards the development of an economic beneficiation process neared completion at the end of the year and full-scale field tests were planned. Feasibility studies were undertaken with a view to recommence shipments of quality rock at a rate of 250,000 tons annually. Discussions with consumers and the Queensland Government were underway.

In 1978, Queensland Phosphate produced 250,000 tons of phosphate rock averaging 32.17% P_2O_5. Production came mainly from the southern area where thicker sections of direct-shipping-grade rock gave a more favorable waste-to-ore ratio. The performance of the treatment plant steadily improved as operating techniques were refined and minor technical improvements were made. The Townsville facilities processed about 252,000 tons of phosphate rock through the dryer. Shipments during the year totaled about 275,000 tons. A total of 215,000 tons were taken by south and east Asian markets and 60,000 tons were shipped to Australian ports. The major share of export sales were to Japan, Republic of Korea, and Malaysia. Sales to Australia were mainly for testing purposes.

Domestically, Queensland Phosphate will have to compete with rock imported from British Phosphate Commission operations in Nauru and the Christmas Islands. The characteristics of rock from these three different sources are different and require slightly different processing methods. The Queensland Phosphate rock had a high silica content, was difficult to grind, and caused adverse chemical reactions in domestic manufacturing plants. The Australian fertilizer manufacturers were unwilling to undertake the necessary capital expenditure in changing from their established source of supply to the Queensland material.

An estimated 11,000 tons of phosphate rock was produced in South Australia in 1980, but the material was not suitable for superphosphate manufacture because of its high iron and aluminum content and was used directly as fertilizer.

Salt.—In 1980, both production and export of salt increased owing to the upturn in the world economy. Four major companies, Dampier Salt Ltd., Leslie Salt Co., Lefroy Salt Pty. Ltd., and Shark Bay Salt Pty. Ltd. (all based in Western Australia), produced about 80% of the total domestic output. Producers in South Australia, Victoria, and Queensland supplied the remainder. Production was by solar evaporation from seawater, saline lake water, and underground brines; salt was also harvested from dry lake beds. Virtually the entire Western Australian output was exported, mainly to Japan, while salt produced in Queensland, Victoria, and South Australia was generally for local consumption. Less than 2% of Australia's total output was consumed as table salt.

In Western Australia, salt production totaled about 4.3 million tons in 1980, and shipments totaled 3.8 million tons. Dampier Salt Ltd. was the principal producer contributing over 2.8 million tons of salt to the State's output. Dampier Salt took over the operations previously controlled by BHP at Lake McLeod and now operates two subsidiary companies, Dampier Salt Pty. Ltd., Dampier Div., and Dampier Salt Pty. Ltd., Lake McLeod Div. The Dampier Div. supplied over 90% of the total production. Lake McLeod was damaged by a cyclone in March 1979 and reconstruction work began in April and continued throughout 1979 and most of 1980. The major components of the

reconstruction program were completed late in 1980 enabling production of about 200,000 tons of salt to be achieved prior to yearend. The Dampier Salt Ltd. output in 1980 came from evaporation pans at Lake McLeod, north of Carnarvon, where extensive reserves of evaporites occur in brines over a 225,000-hectare area. The strata below the lake consisted of a layer of impure gypsum approximately 2 meters thick, underlain by halite (rock salt) ranging in depth to 15 meters. The amount of halite was estimated to exceed 3 million tons.

The halite was impregnated with saturated brine containing about 21% sodium chloride. The brine was extracted from the halite bed by large capacity pumps and flowed to the crystallizing pan area. About 25 crystallizer pans, covering an area of 800 hectares, were used for production. Each pan, with salt deposited about 300 millimeters thick, was harvested once a year. Harvesting proceeded throughout 1980 as various pans were cleared in sequence and then refilled with brine.

Cargille Inc. (formerly Leslie Salt Co.) of Minneapolis, Minn., United States, produced about 1.1 million tons of salt in 1980. This solar salt installation consisted of a series of concentrating and evaporating ponds with associated pumps, a salt washing plant, and shiploading facilities. The operation involved pumping seawater at a rate of up to 180,000 gallons per minute into the evaporation ponds. Solar evaporation brought seawater to a concentrated brine that was nearly the saturation point for sodium chloride. The brine was pumped to crystallizing ponds where further evaporation caused the sodium chloride to precipitate. When the depth of salt in the crystallizing ponds reached approximately 20 centimeters the brine was drained off and the bed of salt harvested.

In 1980, Lefroy Salt produced 200,000 tons from its operations on Lake Lefroy, where reserves were estimated at several hundred million tons. Four new crystallizers were in use during 1980.

Responding to increased domestic requirements, South Australia's salt output in 1980 was significantly above that for 1979. The State's major producers were Imperial Chemical Industries of Australia and New Zealand Ltd. (ICIANZ), Waratah Gypsum Pty. Ltd., Ocean Salt Pty. Ltd., and BHP. ICIANZ produced a combined total of 600,000 tons from seawater by solar evaporation at Dry Creek in 1980. Waratah Gypsum Pty. Ltd. produced around 85,000 tons of salt from Lake MacDonnell, while BHP produced about 60,000 tons at Whyalla. These three companies accounted for about 75% of the State's total output.

Queensland's principal producer was ICIANZ, which operated a solar evaporation project near Rockhampton, utilizing underground brine. Production capacity was about 150,000 tons annually. In Victoria, virtually all of the State's output was produced by Cheetham Salt Ltd. The company operated solar evaporation pans near Laverton on Port Phillip Bay, at Lara and Geelong on Corio Bay, and at Sea Lake near Lake Tyrrel. In 1980, the company produced about 115,000 tons of salt.

Sulfur.—There were no known deposits of native sulfur in Australia, but pyrite was mined for its sulfur content at several locations, and four oil companies have sulfur recovery units. Sulfur was consumed mainly (93%) in the form of sulfuric acid to produce fertilizer, particularly superphosphate. Approximately 70% of the sulfuric acid production was from imported brimstone and 30% was from indigenous raw materials, principally zinc, pyrite, and lead concentrates.

Sulfur was also obtained from petroleum by Petroleum Refineries Pty. Ltd. (Australia) at Altona, Victoria, and Hallett's Cove, South Australia; Shell Refining Pty. Ltd. (Australia) at Clyde, New South Wales, and Geelong, Victoria; Australian Oil Refining Pty. Ltd. at Kernell, New South Wales; and Amoco Pty. Ltd. (Australia) at Bulwer Island, Queensland. The combined capacity of the plants was up to 52,000 tons per year, but the total output from petroleum in 1980 was about 13,000 tons.

Only Electrolytic Zinc Co. of Australia Ltd. at Rosebery and the Mount Lyell Mining and Railway Co. Ltd. produced pyrite for acid production as a byproduct of base-metal mining. Acid from the pyrite was produced at Burnie, Tasmania, by North-West Acid Pty. Ltd. in which the mining companies each have a half interest. The production by North-West Acid totaled 273,018 tons of sulfuric acid in 1980, compared with 252,539 tons in 1979. Progress on construction of the new No. 6 North-West Acid plant was maintained and was virtually completed at yearend.

Exploration work continued on pyrite black slate occurrences near Port Sorell and at Dial Range, both located in Tasmania. Tin deposits at Mount Bischoff and Renison

Bell, also in Tasmania, are associated with enormous deposits of pyrite and pyrrhotite and were being ivestigated.

MINERAL FUELS

Coal.—Despite an extended industrial dispute in the Queensland coalfields in mid-1980, with an estimated 3 million tons in lost production, Australian production of black coal reached a record level in 1980. Increased production from the largest coal-producing State (New South Wales) more than offset the decrease in Queensland. Production also increased in Western Australia and South Australia, but output in Tasmania remained at about the 1979 level. Firm plans were announced for the development of several new mines in Queensland. According to the Australian Joint Coal Board, continued growth is expected in the coal industry, with domestic demand climbing from 35 million tons in 1979 to 75 million to 100 million tons in 1990. Exports are forecast to grow to 115 million to 180 million tons in 1990.

The consumption of coal rose 4% in 1980, mainly as a result of increased electricity generation in New South Wales and Queensland. Black coal exports in 1980 rose by 4%, owing to increased shipments of steaming coal to Japan from New South Wales; exports of coal from New South Wales rose by 16% to 23 million tons. Exports from Queensland were 20 million tons, a 6% decrease from 1979. Japan remained the main market for Queensland coal although shipments were slightly reduced in 1980.

New South Wales currently produces 54% of all coal mined in Australia. Production in 1980, was about 51 million tons, owing to a substantial increase in output in the South Coast district and the Singleton North West district. The industry was preparing for large-scale expansion to serve the expanding markets both at home and abroad. In 1980, 10 major mines were under development, and a number of other mines were being planned or under investigation. These included a number of large surface mines in the Singleton district and proposals by the Electricity Commission for the establishment of new underground mines near Lithgow and Wakefield. The total planned production capacity for these new mines was 12 million tons of coal annually. A significant proportion of this new capacity would serve to replace declining output from existing mines. All of these projects were scheduled to be in production by mid-1980.

Output in Queensland, which accounted for 41% of Australia's coal production, declined in 1980 because of industrial problems. In 1980, 20 underground and 23 surface mines were operating in the State. The upsurge in surface mining began in Queensland in the early 1970's when Utah Development Co. (owned 89.2% by Utah International Inc. of the United States and 10.8% by Utah Mining Australia Ltd.) started coal production. The company operated three open pit coal mines on the western side of the Bowen Basin, at Goonyella, Peak Downs, and Saraji in the Mackay coal mining district, producing over 50% of Queensland's total coal output; most of which was exported. Development work in a fourth open pit mine at Norwich Park, near Saraji began in 1980.

Another Queensland coal producer, Thiess Dampier Mitsui Coal Pty. Ltd., began a $25 million expansion program to boost output at its Moura-Kianga surface mine from 3 million to 5 million tons by 1985. The company also planned to develop two new underground mines in addition to its two existing underground mines. The company has exported coal only to Japan but was examining the prospects in other markets including the Republic of Korea, Taiwan, Europe, the United Kingdom, and the Pacific Basin.

Black coal reserves in Australia were estimated at 229 billion tons at yearend 1980, of this 35 billion tons was indicated and 194 billion tons was inferred. Indicated reserves were located in New South Wales (16 billion tons), Queensland (15.6 billion tons), Western Australia (1.8 billion tons), South Australia (730 million tons), and Tasmania (140 million tons). Substantial deposits of coal have also been delineated in areas not being mined, notably in the Surat Basin (Queensland), at Lake Phillipson in the Arckaringa Basin (South Australia), and in the Corrabin-Oaklands Basin (New South Wales).

Lignite.—Victoria was the only State that produced lignite in 1980. The major deposits in Victoria were in the Latrobe Valley, 130 to 200 kilometers southeast of Melbourne, where the State Electricity Commission, at Yallourn and Morwell, produced more than 95% of the State's total output. The remainder was produced by privately owned mines at Anglesea and Bacchus Marsh. Coal was won by large

draglines with an excavating capacity of 2,000 tons per hour. The Yallourn open pit produced at a rate of 13 million tons annually. Traditionally, production from Yallourn has been used to produce a high-grade solid fuel in the form of briquets for domestic and industrial use. However, briquets were also used as a basis for the production of high-grade char, gas, liquid fuel products, and other chemical industry feedstocks.

Research into production of oil from coal was being sponsored by several governments and private companies. Japanese interests were reported to be willing to establish a demonstration plant for conversion of Victorian lignite into solvent-refined coal suitable for steelmaking. Establishment of a full-scale plant was proposed if the demonstration proves successful.

In 1980, brown coal reserves were estimated at 109 billion tons (40 billion tons indicated and 69 billion tons inferred). Although South Australia has some brown coal deposits, Victoria accounted for all of Australia's brown coal production and about 99% of the country's reserves and resources.

Petroleum and Natural Gas.—Crude oil production decreased compared with 1979, but natural gas output was significantly higher. The Victorian offshore fields (Bass Strait) produced 92.5% of total oil production. The remainder came from Barrow Island, Western Australia, and the nearly exhausted field at Moonie, Queensland. Total oil production represented about 70% of current domestic requirement. With recent discoveries and revised estimates of reserves, it was estimated that this degree of self-sufficiency could be maintained until the mid-1980's.

Australian refineries totaled about 223 million barrels in 1980. Indigenous crude oil comprised about 70% and the remainder was imported, mainly from the Middle East.

An annual summary of petroleum industry statistics produced by the Australian Petroleum Exploration Association showed that in 1980 a total of 27 development wells were drilled, of which 22 were onshore and 5 offshore. There were 82 exploration wells drilled, of which 68 were onshore and 14 offshore. The total exploration expenditure amounted to $300 million. Forecasts for 1981 showed that 137 exploration wells were planned under an exploration budget of $460 million and 86 development wells were scheduled to be drilled under a $1.2 billion budget for development.

Australia's massive North West Shelf Natural Gas Development Project in Western Australia continued to move ahead, despite the absence of firm export contracts. A consortium comprising the BHP Co., Shell Co., Woodside Petroleum Co., British Petroleum, and California Asiatic Oil Co. was continuing a feasibility study that could lead to production by 1984. The aim of the North West Shelf project is to produce gas and condensate from the North Rankin Field, pipe it to shore, and process it into pipeline-quality gas, liquefied natural gas (LNG), and condensate suitable for markets in Australia and abroad. In 1979, the Federal Government approved the export of 55% of the current estimated reserves from the project. About 6.5 million tons of LNG could thus be exported annually over a 20-year period. A contract has been signed between the consortium and the Western Australian State Energy Commission for the sale of up to 10.5 million cubic meters of gas per day over a 20-year period. This would be delivered to customers in the southwest of the State through a 1,300-kilometer-long pipeline from Dampier. Current estimates of the cost of the project now range about $5.8 billion.

Two new development techniques were implemented in the Bass Strait Field during the year that could have important future implications. The first of these, a subsea production installation, was brought into operation on the Cobia 2 well and has enabled limited production from Cobia in advance of the completion of the platform, expected about June 1982.

The second development was the drilling of two high deviation wells from the Mackerel platform into a remote section of the field to recover oil which would be otherwise uneconomic.

Uranium.—Production of U_3O_8 increased in 1980 because Queensland Mines Ltd.'s new concentrator at Nabarlek commenced production in June. For years, Mary Kathleen Uranium Ltd. (MKU) was the only operating uranium mine in Australia. Construction of the Ranger Uranium Mines Pty. Ltd. project is proceeding and is now scheduled to produce U_3O_8 in late 1981. The WMC's Yeelirrie deposit in Western Australia has commenced small-scale mining for use in a research plant at Kalgoorlie. WMC's plant could commence production of U_3O_8 by 1986.

MKU produced 834.5 tons of U_3O_8 in 1980, similar to the 1979 level of 832.0 tons. While

MKU's production is expected to be maintained in 1981, the quantity scheduled to be delivered is significantly lower. MKU is an open pit mine in which ore was mined by conventional drilling, blasting, loading, and hauling equipment. The mine consisted of a series of benches cut into the hill slope to a height of 105 meters above the valley floor and extends to 60 meters below. The ore was processed onsite, and high-grade yellow cake was railed from the mine to Brisbane and shipped to the United States, the Federal Republic of Germany, and Japan.

Queensland Mines Ltd. (Nabarlek) produced 1,006 tons of U_3O_8 during 1980. The company has a contract with the Kyushu Electric Power Co., and the Shekoku Electric Power Co. both of Japan, for the supply of U_3O_8 during the next 10 years. The Nabarlek mill was designed to meet the environmental requirements that was imposed on the Australian uranium industry. The grade of ore is about 2% U_3O_8, and was mined by open pit methods. The mill has a capacity of 200 tons per day and the operation has a life expectancy of approximately 10 years.

In January 1980, the Federal Government announced the formation of the Uranium Enrichment Group in Australia. The group, comprising BHP, CSR Ltd, Peko Wallsend Ltd., and WMC, is studying available enrichment technology and the resultant implications of an enrichment plant in Australia.

Measured reserves in four large deposits in Northern Territory total 297,000 tons of U_3O_8 comprising Jabiluka, 127,000 tons; Ranger, 100,000 tons; Koongarra, 15,000 tons; and Nabarlek, 10,000 tons. The planned initial rate of production was 9,000 tons per year.

The Yeerlirrie deposit in Western Australia has measured reserves of 46,000 tons of U_3O_8, the Beverley and Mount Painter deposits in South Australia have 16,000 tons, and the remaining reserves at MKU were about 7,500 tons. This total of 366,500 tons of U_3O_8 in seven deposits was considered available for immediate development. Numerous other prospects were under investigation throughout the country.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Australian dollars ($A) to U.S. dollars at the rate of $A1.00=US$1.16.

The Mineral Industry of Austria

By William F. Keyes[1]

The Austrian economy grew at the rate of about 3.5% in real terms in 1980, after expanding 5.1% in 1979. This was an unexpectedly strong performance, and a growth rate higher than that of most industrialized countries. Labor-management relations were harmonious, and unemployment was only about 1.9% in 1980. Economic activity diminished somewhat late in the year and was expected to continue to decline in 1981, along with employment. Like the economy, the mining and basic chemical industries showed relatively good results in 1980, except that the repercussions of the international steel crisis were being felt late in the year, leading the Austrian Government to examine measures to achieve a restructuring of the domestic steel industry.

The Government enacted a new Federal law (Bergbaufoerderungsgesetz 1979) designed to promote the domestic production of mineral raw materials, which entered into force retroactively to January 1, 1979, and was to expire on December 31, 1983. The law authorizes financial assistance for the exploration, exploitation, and continuation of mining operations, and for environmental purposes. The legislation is similar to the previous law, which was in effect until the end of 1977, but a major change is the additional inclusion in the types of operations eligible of all nonferrous ores and any ores used in the production of special steels.

The Austrian Ministry of Trade, Commerce, and Industry finished a draft of a plan designed to safeguard the country's raw material supply, about two-thirds of which is imported. Of 52 products that could pose problems if in short supply, 12 were listed as particularly critical, including metallurgical coal, copper, fluxes for the aluminum industry, manganese, alumina, asbestos, chromium, fluorspar, molybdenum, nickel, phosphates, and prime-grade mica. None of the 52 are produced in Austria in significant quantities, although, in a symposium on raw material supply early in 1980, it had been agreed that self-sufficiency could be improved to some extent through exploration and exploitation of domestic raw materials, application of recycling techniques, and development of new processes to conserve and replace materials in short supply. The plan, first of its kind in Austria, was to be distributed for comment to appropriate sectors of the economy during the year.

PRODUCTION

Several industries set production records in 1979, but by late 1980 demand had tapered off, and total minerals output was not expected to reach the 1979 level. Indexes of mining, nonferrous manufacturing, and magnesite were up slightly, but the crude oil production index declined.

Table 1 gives production of minerals and metals in Austria for 1976-80.

Table 1.—Austria: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal:					
Primary	88,670	91,815	91,284	92,693	94,393
Secondary	49,235	39,773	38,382	41,984	31,926
Antimony, mine output, metal content of concentrate	533	512	509	571	662
Cadmium metal	29	26	33	34	36
Copper:					
Mine output, metal content of concentrate	1,138	--	--	--	--
Metal:					
Smelter:					
Primary	900	--	--	--	--
Secondary	19,800	21,500	19,800	21,800	26,100
Total	[r]20,700	[r]21,500	19,800	21,800	26,100
Refined:					
Primary[e]	7,589	9,707	11,485	8,812	8,788
Secondary[e]	21,000	22,000	20,000	24,000	34,000
Total	28,589	31,707	31,485	32,812	42,788
Germanium, metal content of concentrates kilograms	4,700	4,000	4,270	4,500	4,500
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	3,784	3,449	2,788	3,200	3,200
Metal content do	1,165	1,069	866	999	986
Metal:					
Pig iron do	3,318	2,965	3,077	3,702	3,485
Ferroalloys, electric furnace do	8	7	7	9	[e]8
Crude steel do	4,477	4,093	4,335	4,917	4,624
Semimanufactures do	3,510	3,348	3,724	3,992	3,818
Lead:					
Mine output, metal content of concentrate	4,373	4,292	4,633	4,499	4,316
Metal:					
Smelter:					
Primary	6,336	6,315	5,772	5,981	[e]5,400
Secondary	9,885	10,536	9,315	10,825	[e]12,400
Total	16,221	16,851	15,087	16,806	17,800
Refined:					
Primary	9,800	8,400	7,100	7,500	5,500
Secondary	8,600	10,700	10,500	12,400	11,600
Total	18,400	19,100	17,600	19,900	17,100
Manganese, Mn content of domestic iron ore	70,595	64,734	51,351	58,969	58,141
Tungsten, mine output, metal content of concentrate	541	1,116	1,179	1,496	1,495
Zinc:					
Mine output, metal content of concentrate	17,623	19,702	22,479	20,539	19,117
Metal, refined	16,547	16,744	21,655	23,238	22,102
NONMETALS					
Barite	81	192	242	305	249
Cement, hydraulic thousand tons	5,880	5,993	5,735	5,664	5,455
Clays:					
Illite	297,663	464,888	395,103	379,042	504,812
Kaolin:					
Crude	270,742	272,250	275,695	330,094	340,980
Marketable	71,579	74,147	77,000	78,553	83,882
Other	[2]41,896	[2]68,060	98,546	46,073	61,635
Diatomite	1,882	242	536	--	--
Feldspar, crude	3,800	3,645	2,886	6,594	10,946
Graphite, crude	33,057	35,288	40,501	40,519	36,699
Gypsum and anhydrite, crude	770,219	[r]809,101	765,965	798,108	833,417
Lime thousand tons	959	969	1,016	1,022	1,099
Magnesite:					
Crude do	927	1,003	982	1,104	1,318
Sintered or dead-burned do	401	372	421	423	427
Caustic calcined do	125	123	127	121	132
Nitrogen: N content of ammonia do	456	465	470	520	490
Pigments, mineral: Micaceous iron oxide	10,627	9,805	10,560	12,298	10,959
Pumice (trass)	11,683	8,847	8,944	8,162	8,162
Salt:					
Rock thousand tons	1	1	1	1	1
In brine:					
Evaporated do	332	323	321	380	410
Other do	245	146	156	208	209
Total do	578	470	478	589	620

See footnotes at end of table.

Table 1.—Austria: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sand and gravel:					
Quartz sand thousand tons	801	872	821	885	878
Industrial sand do	140	NA	NA	NA	NA
Other sand and gravel do	8,092	8,329	9,767	9,900	9,229
Total do	9,033	9,201	10,588	10,785	10,107
Sodium compounds, n.e.s.:[e]					
Sodium carbonate, synthetic do	168	168	170	170	170
Sodium sulfate, synthetic do	55	55	55	55	55
Stone:[3]					
Dimension do	61	NA	NA	NA	NA
Quartz and quartzite do	205	155	203	218	219
Other, quarry and broken do	1,912	NA	NA	NA	NA
Total do	2,178	NA	11,772	13,042	13,323
Sulfur:					
Byproduct:					
Of metallurgy	8,173	7,774	8,836	9,644	8,731
Of petroleum and natural gas	17,877	24,624	22,586	23,989	18,733
From gypsum and anhydrite	23,184	26,776	26,775	27,102	23,836
Total	49,234	59,174	58,197	60,735	51,300
Talc and soapstone	100,648	103,743	106,848	116,900	116,708
MINERAL FUELS AND RELATED MATERIALS					
Coal, brown, and lignite thousand tons	3,215	3,127	3,076	2,741	2,865
Coke do	1,615	1,458	1,484	1,686	1,689
Gas, natural:					
Gross million cubic feet	75,721	84,502	85,247	81,647	67,211
Marketed do	69,093	77,630	75,280	r e71,850	59,100
Natural gas liquids, condensate thousand 42-gallon barrels	138	170	170	e165	e150
Oil shale	930	420	970	1,160	e1,000
Petroleum:					
Crude thousand 42-gallon barrels	13,466	12,462	12,486	12,044	10,290
Refinery products:					
Gasoline do	13,422	12,903	13,189	14,934	15,115
Jet fuel do	1,135	732	1,003	904	1,053
Kerosine do	96	183	--	84	33
Distillate fuel oil do	18,345	17,546	19,683	20,978	18,970
Residual fuel oil do	25,683	23,684	28,560	29,544	28,974
Lubricants do	1,221	1,198	1,171	1,211	1,070
Other:					
Liquefied petroleum gas do	1,334	1,414	1,416	1,833	1,757
Bitumen do	2,127	2,385	2,214	2,284	2,173
Unspecified do	3,364	3,591	3,976	3,766	e3,630
Refinery fuel and losses do	2,313	2,524	3,539	735	656
Total do	69,040	66,160	74,751	76,273	73,431

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through July 29, 1981.
[2]Excluding clay sand.
[3]Excluding stone used by the cement and iron and steel industries.

TRADE

Diminished demand for Austrian exports showed up in the second half of 1980. Another cause for concern was the fact that the mix of exports continued to be dominated by raw materials and semiprocessed goods, such as nonmetallic minerals and forest products, rather than the higher value manufactured products exported by other industrialized nations. With huge fuel imports, commodities thus dominated Austria's foreign trade.

Tables 2 and 3 report the mineral trade of Austria for 1978 and 1979, the latest years for which data are available.

Table 2.—Austria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	6	27	--	NA.
Oxides and hydroxides including artificial corundum	38,347	47,421	2,524	Poland 10,036; Italy 6,328; United Kingdom 5,994; Romania 5,426.
Metal including alloys:				
Scrap	42,570	38,864	--	Italy 24,531; West Germany 14,068.
Unwrought	11,685	10,306	--	West Germany 6,638; Bulgaria 1,149; Italy 1,116.
Semimanufactures	65,393	72,425	3,639	West Germany 18,644; Belgium 3,800; Switzerland 3,658.
Antimony ore and concentrate	414	493	NA	NA.
Cadmium metal including alloys, all forms	20	25	--	Czechoslovakia 20; West Germany 5.
Chromium:				
Chromite	923	1,028	--	West Germany 960.
Oxides	1	1	--	NA.
Columbium and tantalum: Tantalum metal including alloys, all forms	10	15	NA	NA.
Copper:				
Ore and concentrate	91	116	--	All to West Germany.
Sulfate	1,618	864	--	Italy 859.
Metal including alloys:				
Scrap	2,474	3,242	98	West Germany 1,055; Switzerland 1,052; United Kingdom 601.
Unwrought	18,663	20,142	--	West Germany 8,009; Italy 7,930; Hungary 2,626.
Semimanufactures	13,655	15,470	33	Italy 3,183; West Germany 2,429; France 1,870.
Gold metal including alloys, worked or partly worked, troy ounces	12,249	24,274	--	West Germany 17,201.
Iron and steel:				
Ore and concentrate except roasted pyrite	85	2	NA	NA.
Metal:				
Scrap	7,344	13,904	--	Italy 8,797; Switzerland 3,489; West Germany 1,509.
Pig iron, ferroalloys, similar materials	11,312	12,848	NA	NA.
Steel, primary forms	430,668	506,501	3,160	West Germany 260,025; Yugoslavia 107,091; Italy 87,581.
Semimanufactures:				
Bars, rods, angles, shapes, sections	304,717	366,715	4,746	West Germany 107,299; Italy 90,630; Switzerland 39,455.
Universals, plates, sheets thousand tons	1,063	1,172	9	U.S.S.R. 369; West Germany 331; Italy 119.
Hoop and strip	82,196	105,488	239	Switzerland 18,430; Poland 16,660; West Germany 16,087.
Rails and accessories	86,559	118,877	--	Yugoslavia 32,143; Switzerland 27,091; Romania 16,588.
Wire	54,980	65,993	206	West Germany 17,066; Italy 10,512; Switzerland 6,928.
Tubes, pipes, fittings	162,593	194,084	63	West Germany 38,167; United Kingdom 28,184; Sweden 25,732.
Castings and forgings, rough	r10,978	12,744	674	West Germany 4,070; Sweden 1,665; Netherlands 1,483.
Lead metal including alloys, all forms	686	492	--	Yugoslavia 265; Italy 120; West Germany 47.
Magnesium metal including alloys, all forms	702	694	--	West Germany 362; Italy 233.
Manganese oxide	78	58	--	Mexico 24; Brazil 21.
Mercury, 76-pound flasks	818	438	--	West Germany 209; Belgium 154.
Molybdenum metal including alloys, all forms	872	1,101	NA	NA.
Platinum and platinum-group metals including alloys, all forms, troy ounces	7,652	5,755	--	West Germany 2,733; Romania 2,476.
Silver metal including alloys:				
Bullion, thousand troy ounces	775	1,523	--	West Germany 1,365; Switzerland 126.
Other (powder), do	(1)	3	NA	NA.
Semimanufactures, do	1,138	1,111	--	Yugoslavia 1,051; West Germany 29.
Tin metal including alloys, all forms	96	65	--	United Kingdom 50.
Titanium oxide	65	37	1	West Germany 25.
Tungsten:				
Ore and concentrate	130	25	--	All to United Kingdom.
Metal including alloys, all forms	591	848	NA	NA.
Zinc:				
Oxides	34	636	--	Hungary 600.
Metal including alloys, all forms	863	1,339	--	Czechoslovakia 500; West Germany 474; Italy 129.

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	78	54	--	West Germany 51.
Ash and residue containing nonferrous metals	64,346	68,290	--	Italy 49,012; West Germany 15,035; Spain 2,182.
Waste and sweepings of precious metals including old metals kilograms	r37,178	40,698	--	West Germany 40,165; United Kingdom 302; France 128.
Oxides, hydroxides, peroxides	1,582	1,044	21	Italy 580; West Germany 415.
Base metals including alloys, all forms	4,719	2,975	322	United Kingdom 1,190; Italy 1,076.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	17	11	NA	NA.
Grinding and polishing wheels and stones	12,934	12,792	31	West Germany 2,047; Italy 1,294; Sweden 967.
Dust and powder of precious and semiprecious stones including diamond kilograms	2	(2)	--	NA.
Asbestos	80	2	--	NA.
Cement	29,242	20,631	--	West Germany 15,526.
Chalk	5,980	3,406	--	Hungary 2,660; Italy 322.
Clays and clay products:				
Crude clays:				
Kaolin (china clay)	21,271	25,269	--	Italy 12,338; Hungary 8,565; Yugoslavia 3,242.
Other	199	155	--	Hungary 40; Trinidad and Tobago 25.
Products:				
Refractory including nonclay bricks	168,117	172,887	648	West Germany 30,864; France 20,130; Sweden 13,013.
Nonrefractory	26,280	85,589	--	West Germany 80,072.
Diamond:				
Industrial value	$6,680	$38,674	--	Yugoslavia $37,926.
Other:				
Crude do	$20,176	$35,907	$31,344	NA.
Worked carats	(3)	5,000	--	NA.
Diatomite and other infusorial earth	1,027	1,031	--	Yugoslavia 848; Czechoslovakia 116.
Fertilizer materials, manufactured, phosphatic	38,511	15,077	--	Hungary 12,468; Czechoslovakia 2,606.
Graphite, natural	17,787	17,870	--	Poland 9,755; West Germany 5,631; Italy 1,146.
Gypsum and plasters	189,752	250,801	--	West Germany 207,670; Italy 15,098; Hungary 13,237.
Lime	1,955	1,424	--	West Germany 1,131.
Magnesite	109,536	112,021	--	West Germany 21,983; Hungary 13,771; Poland 11,060.
Mica, all forms	156	312	--	Greece 95; United Kingdom 65.
Pigments, mineral including processed iron oxides	6,905	7,788	106	West Germany 2,172; United Kingdom 1,366; Netherlands 1,002.
Precious and semiprecious stones:				
Crude excluding diamond thousand carats	11,525	5,355	60	West Germany 2,850; Switzerland 1,510.
Manufactured including diamond do	10,820	9,600	2,965	West Germany 1,575; Switzerland 680; Yugoslavia 425.
Pyrite	44	93	--	Spain 35; West Germany 29.
Salt	48	90	--	Italy 87.
Sodium and potassium compounds, n.e.s.:				
Caustic potash	(2)	30	--	NA.
Soda ash	2,100	2,665	NA	Hungary 2,260; Romania 350; Bulgaria 6.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous including marble and limestone	76,671	75,222	--	West Germany 59,012; Switzerland 16,134.
Slate	37	27	NA	NA.
Other	70,863	44,951	--	West Germany 44,108.
Worked:				
Paving and flagstone	13,114	25,429	--	West Germany 16,538; Switzerland 8,430.
Slate	27	46	NA	NA.
Other	2,942	2,334	129	West Germany 1,871; Yugoslavia 129.

See footnotes at end of table.

Table 2.—Austria: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite	8,508	10,597	--	West Germany 7,457; Yugoslavia 971.
Gravel and crushed rock	430,665	486,511	--	Switzerland 293,344; West Germany 187,157.
Limestone except dimension	30	48	--	NA.
Quartz and quartzite	134	93	--	West Germany 55.
Sand excluding metal-bearing	126,716	160,860	--	West Germany 88,890; Switzerland 62,909.
Sulfuric acid, oleum	8,111	12,074	--	Yugoslavia 5,512; Italy 4,237; Czechoslovakia 1,922.
Talc, steatite, soapstone, pyrophyllite	87,097	98,139	--	West Germany 52,029; Italy 13,495; Netherlands 7,964.
Other:				
Crude	4,028	4,905	--	West Germany 3,716; Switzerland 652.
Slag, dross, and similar waste, not metal-bearing	34,648	42,395	--	West Germany 36,082; Italy 6,099.
Oxides and hydroxides of magnesium, barium, strontium kilograms	300	100	NA	NA.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	15	72	NA	NA.
Carbon black and gas carbon	10	13	NA	NA.
Coal including briquets:				
Anthracite and bituminous coal including briquets	28	97	NA	NA.
Lignite and lignite briquets	5,433	11,581	NA	West Germany 11,531.
Coke and semicoke	63,805	12,090	--	Romania 10,981; West Germany 700.
Hydrogen, helium, rare gases thousand cubic feet	54,089	68,216	--	Hungary 37,554; West Germany 10,758; Czechoslovakia 6,990.
Peat including briquets and litter	3	290	--	Italy 220.
Petroleum refinery products:				
Gasoline, aviation and motor thousand 42-gallon barrels	r48	126	--	Yugoslavia 116.
Kerosine and jet fuel do	(2)	(2)	--	NA.
Distillate fuel oil do	1	3	--	Switzerland 2.
Residual fuel oil do	239	5	--	Czechoslovakia 4.
Lubricants do	642	551	--	Czechoslovakia 212; Yugoslavia 98; Poland 91.
Mineral jelly and wax do	90	188	--	Netherlands 130.
Liquefied petroleum gas do	419	484	--	Italy 278; Czechoslovakia 80; West Germany 52.
Other do	50	64	--	Yugoslavia 40; Poland 6; Czechoslovakia 5.
Total do	r1,489	1,421		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	14,526	17,179	--	West Germany 8,733; Yugoslavia 4,578; France 1,882.

rRevised. NA Not available.
[1]Unreported quantity valued at $3,718.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $136,896.

Table 3.—Austria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	40,226	40,231	NA	NA.
Oxides and hydroxides including artificial corundum	217,583	210,007	933	West Germany 11,053; France 2,714.
Metal including alloys:				
Scrap	47,061	44,137	NA	NA.
Unwrought	14,891	30,663	6	West Germany 12,625; Hungary 6,085; Norway 5,313.
Semimanufactures	29,235	36,294	126	West Germany 18,046; Switzerland 6,119; Italy 3,402.
Antimony:				
Ore and concentrate	125	351	--	All from Canada.
Sulfide	20	20	--	All from China, mainland.
Metal including alloys, all forms	52	56	--	Belgium 25; United Kingdom 20; Spain 10.
Arsenic trioxide, pentoxide, acids	24	7	--	NA.
Beryllium metal including alloys, all forms kilograms	NA	3	--	NA.
Cadmium metal including alloys, all forms	4	3	--	West Germany 2.
Chromium:				
Chromite	61,947	57,077	--	Republic of South Africa 25,755; Turkey 9,902; Philippines 5,809.
Oxides and hydroxides	321	424	--	West Germany 226; U.S.S.R. 126.
Cobalt oxides and hydroxides	6	2	--	Belgium 1.
Columbium and tantalum: Tantalum metal including alloys, all forms	15	42	9	West Germany 8; Japan 7; Italy 6.
Copper:				
Ore and concentrate	8	147	--	West Germany 138.
Sulfate	349	431	--	Italy 198; Belgium 81; West Germany 77.
Metal including alloys:				
Scrap	15,601	23,280	154	West Germany 11,606; Hungary 4,557; Italy 2,333.
Unwrought	r21,390	12,890	9	West Germany 3,244; Namibia 2,972; Republic of South Africa 2,468.
Semimanufactures	43,490	52,541	48	West Germany 29,250; United Kingdom 6,320; Sweden 4,218.
Gold metal including alloys, unworked or partly worked troy ounces	r288,617	137,219	386	West Germany 53,563; U.S.S.R. 38,163; Switzerland 17,908.
Iron and steel:				
Ore and concentrate except roasted pyrite thousand tons	2,619	3,963	--	Brazil 1,653; Canada 808; U.S.S.R. 755.
Roasted pyrite	54,424	44,854	--	West Germany 35,431; Yugoslavia 5,228.
Metal:				
Scrap	115,474	134,169	262	West Germany 64,389; Bulgaria 37,580; Czechoslovakia 13,428.
Pig iron including cast iron and similar materials[1]	144,128	94,475	4	Romania 31,989; U.S.S.R. 22,111; West Germany 12,386.
Ferroalloys:				
Ferromanganese	20,525	26,275	38	Norway 17,045; West Germany 5,421.
Other	55,795	61,788	199	Yugoslavia 13,348; Republic of South Africa 8,459; Norway 6,832; Sweden 5,533.
Steel, primary forms	330,037	150,961	--	Poland 33,016; West Germany 30,932; Romania 29,297.
Semimanufactures:				
Bars, rods, angles, shapes, sections	200,517	208,435	72	West Germany 95,593; Italy 53,505; Switzerland 20,183.
Universals, plates, sheets	164,096	182,479	654	West Germany 87,192; Italy 22,790; Belgium 20,027.
Hoop and strip	50,935	62,527	--	West Germany 44,734; Belgium 4,240; Switzerland 3,481.
Rails and accessories	3,830	2,520	--	West Germany 1,564.
Wire	23,351	27,626	623	West Germany 11,079; France 5,072; Belgium 4,467.
Tubes, pipes, fittings	205,082	152,045	174	West Germany 83,776; Italy 20,235; Switzerland 7,346.
Castings and forgings, rough	9,264	10,031	--	West Germany 7,046; Switzerland 680.
Lead:				
Ore and concentrate	4,258	6,193	--	Italy 6,193.
Oxides	810	297	--	France 100; West Germany 91; Switzerland 53.
Metal including alloys:				
Scrap	1,203	1,920	--	Switzerland 988; Hungary 834.
Unwrought	24,510	29,538	83	West Germany 16,187; Yugoslavia 4,987.
Semimanufactures	821	565	--	West Germany 517.

See footnotes at end of table.

Table 3.—Austria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Cement	40,255	37,235	367	West Germany 12,234; Italy 9,775; Yugoslavia 5,245.
Chalk	4,618	6,590	--	Italy 3,037; France 2,725; West Germany 665.
Clays and clay products:				
Crude clay:				
Bentonite	r514	594	176	West Germany 297; Belgium 50.
Kaolin (china clay)	102,546	111,887	13,660	Czechoslovakia 45,398; United Kingdom 38,783; West Germany 9,256.
Other	84,371	95,798	13,836	West Germany 53,214; Czechoslovakia 21,054.
Products:				
Refractory including nonclay brick	18,084	19,971	43	West Germany 13,941; France 1,379.
Nonrefractory	259,310	263,022	--	Italy 170,165; West Germany 70,188.
Cryolite and chiolite, natural	268	261	--	Mainly from Denmark.
Diamond:				
Industrial ---- value	$80,154	$161,430	--	West Germany $67,026; Netherlands $26,855.
Other:				
Crude ---- do	$174,356	$273,115	--	Belgium $151,706; India $32,765; United Kingdom $31,493.
Worked ---- carats	105,000	80,000	NA	Israel 45,000; Belgium 15,000.
Diatomite and other infusorial earth	7,206	7,856	2,153	Hungary 2,525; Denmark 1,543; Czechoslovakia 828.
Feldspar	5,948	4,564	--	Sweden 2,547; West Germany 1,467.
Fertilizer materials:				
Crude:				
Phosphatic	314,341	410,100	NA	NA.
Potassic	19,231	16,302	--	West Germany 11,338; East Germany 4,962.
Other	3,401	4,588	--	West Germany 1,751; Italy 1,675; Switzerland 645.
Manufactured:				
Nitrogenous	80,817	53,479	--	West Germany 33,912; France 16,138.
Phosphatic	79,328	100,205	918	France 48,577; Luxembourg 29,323; West Germany 12,634.
Potassic	271,901	294,098	--	West Germany 6,937.
Other including mixed	97,915	106,488	758	West Germany 99,506; Yugoslavia 2,783; Hungary 2,359.
Ammonia	247	9,638	--	Hungary 5,250; Czechoslovakia 4,212; West Germany 167.
Fluorspar	16,077	18,369	--	East Germany 8,846; West Germany 6,054; Italy 1,404.
Graphite, natural	1,614	1,710	--	North Korea 1,215; West Germany 283.
Gypsum and plasters	11,425	4,558	--	West Germany 4,176.
Lime	923	2,040	--	West Germany 1,720; Italy 231.
Magnesite	88,561	113,186	--	Turkey 34,528; Italy 30,252; Israel 20,545.
Mica:				
Crude including splittings and waste	340	250	--	West Germany 141; Netherlands 39; Norway 36.
Worked including agglomerated splittings	131	106	--	Belgium 40; Switzerland 37; West Germany 12.
Pigments, mineral: Iron oxides, processed	2,907	3,086	--	West Germany 2,927.
Precious and semiprecious stones:				
Crude other than diamond ---- thousand carats	95,760	55,970	--	Brazil 26,740; West Germany 16,035; Italy 4,260.
Manufactured ---- do	84,770	70,605	925	Switzerland 49,530; France 17,735.
Pyrite, gross weight	5,856	3,264	--	U.S.S.R. 2,589; Italy 515.
Salt including brine salt	r63,506	49,453	--	West Germany 46,167; Switzerland 3,078.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	72,612	85,151	--	West Germany 58,468; Switzerland 15,204; Poland 5,617.
Caustic potash	1,724	1,338	--	Italy 566; West Germany 318; East Germany 135.
Soda ash	2,570	1,784	--	East Germany 1,282; Italy 228.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous including marble and limestone	6,580	6,024	--	Italy 3,915; West Germany 1,158.
Slate	1,223	1,082	--	France 596; West Germany 251; Republic of South Africa 164.
Other	36,155	35,827	1,676	Italy 21,089; Republic of South Africa 6,024.
Worked:				
Paving and flagstone	9,896	13,406	--	Italy 5,675; Romania 3,568; Yugoslavia 1,631.
Slate	513	426	--	Italy 143; Norway 73; Spain 57.
Other	31,636	34,725	--	Italy 28,120; West Germany 5,066.

See footnotes at end of table.

Table 3.—Austria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Magnesium metal including alloys, all forms	1,908	2,249	426	Norway 1,269; Italy 265; West Germany 216.
Manganese:				
Ore and concentrate	520	433	--	Netherlands 185; West Germany 184.
Oxides	149	129	--	West Germany 59; Canada 30.
Mercury 76-pound flasks	415	690	--	Italy 331; China, mainland 235.
Molybdenum:				
Oxides	1,375	1,639	--	West Germany 40.
Metal including alloys, all forms	87	366	282	Canada 48.
Nickel:				
Matte, speiss, similar materials	1,362	1,533	719	Cuba 470; Netherlands 131; Norway 90.
Metal including alloys:				
Scrap	263	1,504	291	Czechoslovakia 483; West Germany 238; United Kingdom 159.
Unwrought	2,400	2,849	1,009	West Germany 809; Republic of South Africa 300; Hungary 266.
Semimanufactures	627	555	168	West Germany 234; United Kingdom 58; Sweden 40.
Platinum and platinum-group metals including alloys, all forms troy ounces	75,200	38,774	32	West Germany 35,044.
Rare-earth metals: Yttrium and scandium	6	170	--	France 90; Brazil 60; United Kingdom 19.
Silver metal including alloys:				
Bullion thousand troy ounces	7,256	3,757	--	United Kingdom 1,304; West Germany 1,053; Poland 671.
Other (powder) do	(2)	4	--	Mainly from West Germany.
Semimanufactures do	4,318	2,566	--	West Germany 2,380.
Tin:				
Oxides and hydroxides	12	10	--	All from West Germany.
Metal including alloys, all forms	574	650	--	West Germany 276; Thailand 205.
Titanium oxides	10,349	8,964	--	West Germany 5,779; Finland 823; Italy 739.
Tungsten:				
Ore and concentrate	4,533	4,853	NA	NA.
Oxides and hydroxides	131	167	NA	NA.
Metal including alloys, all forms	492	728	118	Netherlands 132; West Germany 117; Belgium 105.
Uranium and thorium: Oxides	572	607	100	France 319; India 100; Brazil 25.
Zinc:				
Ore and concentrate	1	5,621	--	Italy 3,037; Yugoslavia 1,479; West Germany 1,105.
Oxides	740	841	--	West Germany 664; France 107.
Metal including alloys:				
Scrap	322	579	--	Hungary 495; Yugoslavia 84.
Blue powder	843	1,266	--	Belgium 408; Netherlands 294; France 241.
Unwrought	4,080	4,469	--	West Germany 3,137; Zambia 826; Belgium 200.
Semimanufactures	1,982	1,763	--	West Germany 1,369.
Other:				
Ores and concentrates	10,207	10,757	1,972	Netherlands 3,552; Australia 1,440; United Kingdom 954; Chile 748.
Ash and residue containing nonferrous metals	102,681	128,618	756	U.S.S.R. 66,595; Hungary 15,159; East Germany 12,626.
Waste and sweepings of precious metals including old metals kilograms	r2,669	16,132	--	Switzerland 15,000; Yugoslavia 629.
Oxides, hydroxides, peroxides	3,804	3,707	74	Republic of South Africa 2,819; Netherlands 301; West Germany 236.
Base metals including alloys, all forms	2,622	3,879	222	U.S.S.R. 2,550; West Germany 236; Belgium 192.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	266	185	--	Italy 83.
Dust and powder of precious and semiprecious stones including diamonds kilograms	144	223	185	Switzerland 22.
Grinding and polishing wheels and stones	935	1,058	7	West Germany 599; Italy 126.
Asbestos	30,807	23,912	62	Canada 12,060; Republic of South Africa 5,043; U.S.S.R. 3,362; Italy 3,216.
Barite and witherite	6,976	3,228	--	West Germany 2,439; Czechoslovakia 787.
Boron materials:				
Crude natural borates	16,421	16,044	6,031	Turkey 9,888.
Oxides and acid	851	1,025	--	France 559; Italy 369.

See footnotes at end of table.

Table 3.—Austria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory grade	4,831	5,633	--	Italy 3,577; West Germany 1,487.
Gravel and crushed rock	405,025	391,279	--	West Germany 368,402; Italy 22,276.
Limestone except dimension	2,303	2,934	--	West Germany 2,934.
Quartz and quartzite	18,818	20,556	--	West Germany 14,423; Hungary 4,660.
Volcanic material (trass)	880	985	--	West Germany 974.
Sand excluding metal-bearing	597,619	586,965	--	West Germany 334,318; Czechoslovakia 210,205.
Sulfur:				
Elemental, all forms	101,556	112,082	--	Poland 66,579; West Germany 39,254; Hungary 4,850.
Sulfuric acid, oleum	1,376	5,023	--	West Germany 4,463; Switzerland 554.
Talc, steatite, soapstone, pyrophyllite	2,427	2,746	--	Norway 683; France 619; Belgium 564; Italy 523.
Other:				
Crude	51,284	64,229	1,563	West Germany 28,616; Hungary 23,365.
Slag, dross, and similar waste, not metal-bearing	50,451	33,818	--	Italy 23,840; West Germany 9,016.
Oxides and hydroxides of magnesium, strontium, barium	561	645	--	West Germany 641.
Halogens	4,095	6,369	--	Italy 4,711; Hungary 1,645.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	862	1,796	85	Trinidad and Tobago 1,434; West Germany 263.
Carbon black and gas carbon	22,522	26,750	625	West Germany 14,116; Italy 10,059; United Kingdom 1,083.
Coal including briquets:				
Anthracite and bituminous coal thousand tons	2,292	2,794	89	Poland 1,031; Czechoslovakia 719; U.S.S.R. 712.
Briquets of anthracite and bituminous coal	23,286	29,729	--	West Germany 29,091; Italy 638.
Lignite and lignite briquets	510,550	498,084	--	Yugoslavia 214,792; East Germany 167,987; West Germany 110,381.
Coke and semicoke thousand tons	919	1,174	--	Czechoslovakia 460; West Germany 353; Poland 261.
Gas, natural thousand cubic feet	98,062	102,507	--	U.S.S.R. 101,818.
Hydrogen, helium, rare gases do	180,247	128,244	358	West Germany 99,189; Hungary 24,854.
Peat including peat briquets and litter	44,954	54,078	--	West Germany 24,156; U.S.S.R. 22,800.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	59,754	65,601	--	Iraq 26,599; U.S.S.R. 12,648; Saudi Arabia 8,308.
Refinery products:				
Gasoline, aviation and motor do	r6,219	6,117	--	Italy 2,882; West Germany 2,231; Hungary 591.
Kerosine and jet fuel do	r59	130	(3)	West Germany 70; Czechoslovakia 45.
Distillate fuel oil do	1,386	1,694	(3)	West Germany 700; Italy 557; East Germany 165.
Residual fuel oil do	6,748	5,741	--	West Germany 2,622; East Germany 1,063; Italy 726.
Lubricants do	939	906	4	Netherlands 134; West Germany 123; Hungary 117.
Mineral jelly and wax do	111	116	(3)	West Germany 73; Hungary 19; East Germany 10.
Liquefied petroleum gas do	684	725	--	West Germany 339; Hungary 296; U.S.S.R. 61.
Other do	804	729	20	West Germany 348; Norway 27; Netherlands 13.
Total do	16,950	16,158		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	21,844	19,202	--	West Germany 6,170; Poland 5,338; Romania 3,414.

rRevised. NA Not available.
[1]Including spiegeleisen, powder, and shot.
[2]Unreported quantity valued at $15,335.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Iron and Steel.—Although the steel industry set a new record in 1979 with production of 4.9 million metric tons of crude steel, declining demand late in 1980 led to production cutbacks of at least 15%. Significant financial losses were suffered during the year, and according to the chairman of the major steel producer, Vöest Alpine Montan AG (VAM), prospects for 1981 were also unfavorable. VAM at yearend was operating at 80% of capacity.

VAM continued to shift to advanced technology. Basic oxygen steel production increased in 1979 to 4.1 million tons, or 84.9% of the total, while continuous casting continued to expand its proportion of steel produced. The output of electric steel also grew 12.7% in 1979, compared with the 1978 level.

The Oesterreichische Industrieverwaltungs AG, the state holding company, commissioned a study of Vereinigte Edelstahlwerke AG (VEW), the nationalized specialty steel producer, from Booz, Allen, and Hamilton Inc. in mid-1980. The report was finished early in 1981, and while it was not immediately published, its conclusions were widely discussed.

Reportedly, Booz-Allen considered VEW to be overstaffed and burdened with identical production lines in too many locations. The survey proposed the complete closure of the Judenburg plant, which employed 1,600 persons producing rolling mill products, springs, and forgings; transfer of production of steel bars at Muerzzuschlag-Hoenigsberg to Kapfenberg, thus making redundant 450 workers out of 2,100, but continuation of sheet production at Muerzzuschlag; closing of departments making high-speed tools and heavy forgings at Kapfenberg-Deuchendorf, thus idling some 850 out of 7,300, including employees of the finishing departments and VEW's research center at Deuchendorf; closing the casting plant at Ternitz, causing 550 persons out of 4,000 to lose their jobs; closure of the departments for die forgings and steel tubes at the Ybbstahl works, and transfer of this work to VAM's main plant in Linz, at a cost of 300 jobs out of 1,500; and transfer of some administrative responsibilities, including sales, from Vienna to plant offices, thus eliminating between 250 and 500 white collar positions. The Booz-Allen plan, if adopted, would reduce employment at VEW from 19,000 to about 15,000, or 20%.

It was not immediately apparent what the ultimate reaction of VEW management and the Government would be to the Booz-Allen plan, but reaction from workers' councils was strongly adverse and local communities appealed to the Government to consider the impact on the entire regional economy.

NONMETALS

Graphite.—Almost all the graphite produced in Austria is amorphous. Production from two distinct regions has been declining in the past two decades, and is currently about 40,000 tons of crude graphite. The largest producer, the Kaiserberg Mine of Graphitbergbau Kaisersberg Franz Mayr-Melnhof & Co., 10 miles southwest of Leoben, mined graphite containing 40% to 88% carbon. Production was largely foundry grades with a small production of microcrystalline flotation concentrate. The company also operated the Trieben-Hohentauern Mine 20 miles west of Leoben.

Production in Lower Austria, near Muhldorf and Zettlitz, of a more crystalline variety was from old dumps by the firm Pryssok & Co. KG.

MINERAL FUELS

The 1980 Energy Report of the Austrian Trade Ministry was published at yearend. It forecast a level of 1985 gross domestic energy consumption of 24.9% above 1976, compared with 35.4% above 1976 estimated in the 1979 Energy Report. Nevertheless, the overall energy consumption was forecast to increase at a rate of 2.7% annually through 1985 and 2.2% annually from 1985 through 1990. In 1979, some 67.5% of energy needs were met through imports; this figure will reach 70% in 1985 and 75% by 1990.

A major target of Austrian energy policy is compliance with the recommendation of the International Energy Agency that calls for substitution of coal for petroleum products. Other major goals include exploration and exploitation of domestic energy resources to the largest extent possible, a reduction in the rate of energy growth, and diversification of foreign supplies. According to the Energy Report, protection of energy supply was accorded the same im-

portance, in the public eye, as protection of the environment.

Coal.—Production (all of lignite) continued to decline in 1979, by over 10% to 2.7 million tons, as a result of the 1978 closing of the major Fohnsdorf Mine. This level of output was expected to continue until the new open pit at the Oberdorf Mine at Barnbach, in the area of Graz, comes into operation, about 1983, at an ultimate production rate of 1 million tons per year. Study of a possible mine on the Hungarian border was underway; both developments were being undertaken by the Graz-Köflacher Eisenbahn und Bergbaugesellschaft, the Government's largest coal company. Coal was also produced by Wolfsegg-Traunthaler Kohlenwerk AG at two mines near Ampfelwang, and by Salzach Kohlenbergbau GmbH at Trimmelkam; all three mines are near Salzburg.

In June, a contract was signed for annual deliveries of 1.2 million tons of Polish coal for 20 years, beginning in 1983. An Austrian coal delegation visited the United States in November to discuss possible purchases of U.S. coal as part of the Government's policy to diversify sources of supply. The only Austrian imports from the United States hitherto had been initial small shipments from the West Virginia mine purchased recently by VAM, the Government's steel company.

Natural Gas.—Natural gas provides about 20% of Austria's energy. In 1979, almost half of the 4.6 billion cubic meters consumed was domestic production, but 99% of the remainder came from the Soviet Union, the highest dependence of any nation in Western Europe on Soviet gas. Reports of irregularities in deliveries of these imports caused the Austrian Government to reassure the public that fluctuations were a result of seasonal factors. Austrian officials were also endeavoring to obtain Soviet agreement to expand future deliveries.

Austria has imported natural gas from the Soviet Union since 1968, when it signed a contract for 1.5 billion cubic meters annually until 1990. Subsequent agreements were signed in 1974 for an additional 500 million cubic meters annually from 1978 to 2000, and in 1975 for a further 500 cubic meters annually until the year 2000. The present desire of the Austrian Government was to obtain a further 1.5 to 3 billion cubic meters annually beginning about 1985. Negotiations with the Soviets were focused on the price to be paid because the rising cost of energy imports had led to an Austrian deficit in the bilateral trade account of AS6.3 billion[2] ($470 billion) in the first 10 months of 1980, compared with AS2.9 billion ($220 billion) in the same period of 1979.

Reserves of natural gas in Austria were estimated at about 10.6 billion cubic meters (375 billion cubic feet) as of January 1, 1980, not including associated gas, which was currently about 16% of total production.

Petroleum.—The state oil company, Österrerchische Mineralölverwaltungs AG (OMV), had six exploratory drill rigs operating on existing fields, chiefly in the Vienna basin. Two gas finds and one oil find were made in 1979; the gas finds were Aderklaa West 1, 5 miles northeast of Vienna, and Stockerau Ost 2, 12 miles northwest of Vienna; the oil find was Wolkersdorf 6, 10 miles northeast of Vienna. The Zistersdorf UT (Uebertief) 1 well, near the Czechslovakian border, struck gas at 7,544 meters, the target depth, early in 1980.

The Austrian Government during the year made several technical changes in the terms of concession agreements. Existing rights of the companies involved, however, were extended until negotiations could be completed. OMV was by far the largest of these companies, holding 100% interest in 9,555 square miles. Rohoel-Aufsuchungs GmbH had interests in 2,480 square miles. A third group, consisting of Vorarlberger Erdoel und Ferngas GmbH (51%), Elwerath (14.16%), Deutsche BP (11.97%), Preussag AG (14.7%), and Wintershall AG (8.17%), holds about 385 square miles. Two other small tracts, both less than 1 square mile, are held by Van Sickle GmbH and by Erdgasbergbau Wels.

Austria's domestic production of crude oil declined to about 1.5 million metric tons in 1980 from 1.7 million in 1979, but the value of production rose from AS3.2 billion ($240 million) to AS4.2 billion ($330 million). Consumption of petroleum products also declined, from 11.7 million metric tons in 1979 to 11.2 million in 1980. Reasons given for the decline in consumption were higher prices and a decline in the growth rate of the gross domestic product from 5.1% in 1979 to 3.5% in 1980.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Austrian schillings (AS) to U.S. dollars at the average rate of AS12.9=US1.00.

The Mineral Industry of Belgium-Luxembourg

By William F. Keyes[1]

By late 1980, the Belgian economy, with a gross national product (GNP) of about $120 billion, appeared headed into a new recession, following the downturn in the economies of some of its major trading partners, particularly the Federal Republic of Germany, and the upturn that took place in 1979 appeared to have ended. Added to the problems were political instability, with the fourth Government (administration) in 18 months, high unemployment, and Government deficits.

Except for coal, Belgium lacks significant mineral resources of its own, but the production of steel and nonferrous metals from imported ores is important. Both coal and steel were in trouble during the year. The coal mining industry has been kept viable for years by Government assistance and continued assistance was anticipated. The steel industry which, with nonferrous metals, added about 2% to the GNP in 1980 compared with 4.3% in 1974, and 18% to Belgian exports, was in serious trouble because of the continued imbalance between worldwide capacity and demand and because of the age, inefficiency, and labor-intensiveness of much of the installed capacity. The Government devoted a great deal of attention to steel during the year, and a costly rescue plan was evolving.

PRODUCTION

The general production index, which rose somewhat to 126.0 in 1979, was 124.0 in the first 9 months of 1980; coal was similarly steady at 40.0 in both periods. The index of nonferrous metals production rose from 155.8 in 1979 to 169 in the first half of 1980. The steel index declined from 109.1 in 1979 to 107.0 in the first 9 months of 1980; in September it reached the extraordinarily low level of 71.0 (all indexes are based on 1970=100).

Production of minerals and metals in Belgium from 1976 to 1979, and estimates for 1980, are given in table 1.

Table 1.—Belgium: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal, secondary only	2,600	3,600	3,579	4,593	4,700
Cadmium, smelter	1,200	1,440	1,164	1,440	[3]1,500
Copper:					
Blister:					
Primary[e]	14,000	13,000	9,000	[r]1,500	1,500
Secondary[e]	58,000	48,600	46,900	47,800	50,000
Total	72,000	61,600	55,900	49,300	51,500
Refined, primary and secondary, including alloys	425,000	464,700	388,600	368,800	[3]373,500
Iron and steel:					
Iron ore and concentrate thousand tons	63	47	43	--	--
Pig iron do	9,877	8,924	10,260	10,776	[3]9,849
Ferroalloys: Electric-furnace ferromanganese do	84	55	87	90	85
Steel:					
Crude do	12,145	11,256	12,601	13,442	[3]12,320
Semimanufactures do	9,588	9,387	10,518	10,354	[3]9,516
Lead metal:					
Primary	106,000	104,000	104,200	80,200	90,000
Secondary	15,524	18,796	20,840	33,200	25,000
Total	121,524	122,796	125,040	113,400	115,000
Selenium[e] kilograms	60,000	60,000	60,000	60,000	60,000
Tin metal:					
Primary	4,068	3,520	3,295	2,165	3,000
Secondary	1,992	1,484	1,901	1,743	1,600
Total	6,060	5,004	5,196	3,908	4,600
Zinc:					
Slab zinc:					
Primary	234,748	247,628	233,916	256,720	250,000
Secondary (remelted zinc)	6,500	10,600	6,600	5,000	5,000
Total	241,248	258,228	240,516	261,720	255,000
Zinc powder	42,420	43,632	32,904	28,300	27,000
Other, nonferrous:					
Precious metals, unworked, n.e.s.[4] thousand troy ounces	30,637	29,373	29,732	29,732	30,000
Base metals, unspecified[5]	6,004	3,432	[e]2,576	NA	NA
NONMETALS					
Cement, hydraulic thousand tons	7,504	7,764	7,576	7,703	7,700
Clays: Kaolin do	120	120	120	120	120
Gypsum and anhydrite, calcined	219,708	167,436	183,492	192,936	190,000
Lime and dead-burned dolomite:					
Quicklime thousand tons	2,304	2,316	2,304	3,354	3,300
Dead-burned dolomite do	209	172	167		
Nitrogen: N content of ammonia do	539	584	492	531	[3]538
Phosphates: Thomas slag, gross weight do	972	841	853	1,052	1,000
Sodium compounds:					
Sodium carbonate	351,456	441,444	427,443	[e]435,000	435,000
Sodium sulfate	310,000	250,000	250,000	250,000	250,000
Stone, sand and gravel:					
Calcareous:					
Dolomite thousand tons	2,685	2,524	3,489	3,354	3,300
Limestone do	24,156	29,076	27,048	29,084	29,000
Marble:					
In blocks cubic meters	2,340	3,048	3,612	3,053	3,000
Crushed and other	4,944	3,132	5,508	2,511	2,800
Petit granite (Belgian bluestone):					
Quarried cubic meters	739,800	679,656	693,024	679,654	650,000
Sawed do	67,944	68,292	71,328	68,288	60,000
Worked do	9,336	9,612	11,856	9,608	10,000
Crushed and other do	626,916	577,080	554,160	577,076	550,000
Porphyry, all types thousand tons	6,288	5,726	5,374	5,926	6,000
Quartz and quartzite	311,422	244,580	315,179	244,580	250,000
Sandstone:					
Rough stone including crushed thousand tons	2,267	2,494	2,303	2,494	2,400
Paving and mosaic stone	894	2,845	19,272	31,072	25,000
Other	40,773				

See footnotes at end of table.

Table 1.—Belgium: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Stone, sand and gravel —Continued					
Sand and gravel:					
Construction sand ____ thousand tons__	9,744	9,364	7,981	9,361	9,100
Foundry sand ____ do____	1,044	1,039	1,043	1,039	1,000
Dredged sand ____ do____	1,236	1,242	923	NA	NA
Glass sand ____ do____	1,620	1,661	1,602	1,661	1,600
Other sand ____ do____	2,244	1,956	1,915	2,734	2,500
Gravel, dredged ____ do____	6,912	7,686	5,566	NA	NA
Sulfur, byproduct:					
Elemental ____ do____	35	88	110	110	110
Other forms ____ do____	183	169	157	160	160
Total ____ do____	218	257	267	270	270
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e] ____	2,000	2,000	2,000	2,000	2,000
Coal:					
Anthracite ____ thousand tons__	1,126	796	628	796	824
Bituminous ____ do____	6,112	6,272	5,963	5,476	5,500
Total ____ do____	7,238	7,068	6,591	6,272	[3]6,324
Coke, all types ____ do____	6,216	5,568	5,748	6,444	[3]6,048
Fuel briquets, all kinds ____ do____	166	126	125	126	125
Gas:					
Manufactured ____ million cubic feet__	25,765	[r]23,561	24,554	NA	25,000
Natural ____ do____	1,186	1,362	858	1,728	800
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels__	33,448	43,155	40,928	29,832	NA
Jet fuel ____ do____	8,544	14,024	11,968	8,882	NA
Kerosine ____ do____	302	1,008	527	844	NA
Distillate fuel oil ____ do____	67,677	86,230	80,038	88,043	NA
Residual fuel oil ____ do____	68,558	84,482	71,735	68,039	NA
Lubricants ____ do____	707	714	616	686	NA
Other ____ do____	25,634	26,038	19,040	32,004	NA
Refinery fuel and losses ____ do____	8,195	13,079	13,086	12,096	NA
Total ____ do____	213,065	268,730	237,938	240,426	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 23, 1981.

[2]In addition to the commodities listed, Belgium produces a number of other metals for which only aggregate output figures are available. These aggregates are included under "Other nonferrous metals."

[3]Reported figure.

[4]Known to include gold and silver and may include platinum-group metals.

[5]Derived by subtracting aluminum data from a reported total for unspecified base metals.

TRADE

Belgian minerals trade is detailed in tables 2 and 3 for the years 1978 and 1979, the latest for which complete data are available.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destination, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	689	4,531	--	West Germany 4,467.
Oxide and hydroxide	185	1,151	NA	France 625.
Ash and residue containing aluminum	5,475	7,508	--	West Germany 6,170.
Metal including alloys:				
Scrap	28,726	33,532	NA	France 14,342; West Germany 8,850; Netherlands 7,063.
Unwrought	10,185	10,842	NA	West Germany 5,303; France 4,642.
Semimanufactures	227,256	242,534	23,857	France 52,470; West Germany 40,646; Netherlands 26,435.
Antimony:				
Ore and concentrate	--	5	--	NA.
Metal including alloys, all forms	52	6	--	NA.
Beryllium metal including alloys, all forms kilograms	500	14	--	NA.
Cadmium metal including alloys, all forms	735	809	195	West Germany 271; France 192.
Chromium:				
Chromite	447	19	--	NA.
Oxide, hydroxide, trioxide	50	97	NA	NA.
Metal including alloys, all forms	422	509	NA	West Germany 263; United Kingdom 69; France 55.
Copper:				
Ore and concentrate	3,443	733	NA	Netherlands 282; West Germany 206; Denmark 80.
Copper sulfate	12,359	13,095	NA	Netherlands 2,938; West Germany 2,760; Denmark 1,496.
Ash and residue containing copper	1,479	1,886	--	France 841; West Germany 502; United Kingdom 216.
Metal including alloys:				
Scrap	19,912	26,846	NA	West Germany 12,140; France 5,821.
Unwrought	313,376	306,934	1,681	France 106,317; West Germany 76,502.
Semimanufactures	282,534	282,518	15,276	France 107,408; West Germany 77,421.
Gold:				
Waste and sweepings value, thousands	$109	$806	--	Netherlands $457; West Germany $349.
Metal, unworked or partly worked thousand troy ounces	894	583	1	Switzerland 315; United Kingdom 113; West Germany 110.
Iron and steel:				
Ore and concentrate, except roasted pyrite	r83,851	3,172	--	NA.
Roasted pyrite	r153,437	154,153	NA	West Germany 144,883.
Metal:				
Scrap thousand tons	532	550	NA	West Germany 225; France 177.
Pig iron including cast iron do	37	23	NA	Netherlands 9; West Germany 8; France 5.
Sponge iron, powder, shot do	351	776	NA	West Germany 136; France 128.
Spiegeleisen	235	61	--	NA.
Ferroalloys:				
Ferromanganese thousand tons	30	44	NA	France 21; West Germany 14.
Other do	42	46	NA	West Germany 6; France 2; Italy 1.
Steel, primary forms do	2,676	3,224	NA	France 1,475; West Germany 696; Italy 353.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	4,172	4,177	424	West Germany 1,046; France 613; Netherlands 474.
Universals, plates, sheets do	5,239	5,414	235	France 1,390; West Germany 1,276; Netherlands 590.
Hoop and strip do	770	800	(1)	West Germany 327; France 209; Netherlands 27.
Rails and accessories do	81	86	7	France 21; Italy 18; Netherlands 2.
Wire do	465	476	52	West Germany 98; France 78; Netherlands 46; Italy 27.
Tubes, pipes, fittings do	357	370	6	West Germany 85; Algeria 63; Netherlands 49.
Castings and forgings, rough do	11	13	1	Netherlands 6; West Germany 4.
Total do	11,095	11,336		
Lead:				
Ore and concentrate	25	1,196	--	All to Romania.
Oxide	5,778	5,406	NA	Netherlands 2,583; West Germany 1,733.
Ash and residue containing lead	8,568	4,678	--	Italy 1,640; France 1,366; West Germany 936.
Metal including alloys:				
Scrap	15,653	22,531	NA	France 15,886; West Germany 3,742.
Unwrought	85,987	74,180	2,539	West Germany 19,331; Netherlands 17,970; U.S.S.R. 10,353.
Semimanufactures	5,716	6,597	NA	Netherlands 5,062.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destination, 1979	
			United States	Other (principal)
METALS —Continued				
Magnesium metal including alloys:				
Scrap	368	524	115	Netherlands 125.
Unwrought and semimanufactures	145	3	NA	NA.
Manganese:				
Ore and concentrate	11,324	6,107	NA	United Kingdom 2,840; Netherlands 2,157; Italy 554.
Metal including alloys, all forms	76	26	NA	NA.
Mercury 76-pound flasks	1,633	516	NA	NA.
Molybdenum:				
Ore and concentrate	5,872	5,945	NA	West Germany 1,688; Italy 1,310; Austria 680.
Metal including alloys, all forms	121	177	6	Netherlands 76; United Kingdom 35; West Germany 31.
Nickel:				
Ore and concentrate	1	--		
Matte, speiss, similar materials	1	1	--	NA.
Metal including alloys:				
Scrap	1,220	1,656	129	India 682; West Germany 526.
Unwrought	331	406	20	West Germany 149; United Kingdom 80; Poland 48.
Semimanufactures	1,902	1,040	NA	West Germany 35; United Kingdom 13.
Platinum-group metals including alloys, all forms troy ounces	117,668	113,239	27,196	West Germany 42,711; France 16,507; Netherlands 13,992.
Selenium, elemental kilograms	157,200	NA	NA	NA.
Silver metal including alloys, all forms thousand troy ounces	20,994	21,262	2,491	United Kingdom 6,112; France 3,346; Switzerland 3,106.
Tin:				
Ore and concentrate	56	75	--	Spain 56; France 19.
Oxide kilograms	r1,200	300	--	NA.
Metal including alloys:				
Scrap	149	92	--	Netherlands 34; West Germany 12.
Unwrought	2,417	2,372	NA	France 770; West Germany 415; Netherlands 347.
Semimanufactures	71	23	NA	Netherlands 9; Burundi 7.
Titanium:				
Ore and concentrate	3	--		
Oxide	28,457	23,304	1,672	West Germany 8,613; Italy 2,118; France 1,897.
Metal including alloys, all forms	164	191	NA	West Germany 68; France 18; Netherlands 16.
Tungsten:				
Ore and concentrate	45	9	NA	NA.
Metal including alloys, all forms	215	159	NA	Netherlands 70; West Germany 69.
Uranium ore and concentrate	547	403	--	All to France.
Vanadium oxide	105	211	NA	Czechoslovakia 121; West Germany 36; United Kingdom 36.
Zinc:				
Ore and concentrate	11,676	60,645	NA	France 47,803.
Oxide	4,862	7,119	NA	France 1,753; Hungary 1,254; West Germany 1,247.
Ash and residue containing zinc	42,685	34,727	NA	France 14,009; West Germany 13,400; Netherlands 514.
Metal including alloys:				
Scrap	4,147	5,369	NA	Netherlands 2,343; France 2,070.
Blue powder	18,405	18,765	NA	West Germany 11,634; France 1,710.
Unwrought	187,102	193,626	10,305	West Germany 76,748; France 48,925.
Semimanufactures	9,108	9,294	17	West Germany 5,079; Netherlands 1,958.
Other:				
Ores and concentrates:				
Of niobium, tantalum, vanadium, zirconium	51	79	NA	West Germany 40; Japan 2.
Of precious metals kilograms	200	NA	NA	NA.
Of base metals, n.e.s	72	3,427	NA	West Germany 3,426.
Ash and residue containing nonferrous metals, n.e.s	43,969	60,384	NA	Netherlands 47,494; West Germany 10,881.
Waste and sweepings of precious metals, n.e.s value, thousands	$7,421	$5,256	--	United Kingdom $3,546; West Germany $1,441.
Oxides, hydroxides, peroxides of metals, n.e.s	2,486	2,807	260	Netherlands 1,113; West Germany 453; France 201.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destination, 1979	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Metals including alloys, all forms:				
Metalloids:				
Tellurium and arsenic	24	22	NA	West Germany 12; France 7.
Other	119,636	162,617	(1)	Netherlands 112,568; France 38,745.
Alkali, alkaline-earth, rare-earth metals	69	20	NA	NA.
Pyrophoric alloys	1	--		
Base metals including alloys, all forms, n.e.s	293	307	31	West Germany 112; Austria 92; Finland 24.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	245	1,137	NA	NA.
Dust and powder of precious and semiprecious stones, natural and manufactured kilograms	958	1,080	318	United Kingdom 192; Israel 83; Netherlands 74; Spain 61.
Grinding and polishing wheels and stones	2,381	2,358	NA	France 1,440; West Germany 278; United Kingdom 259.
Asbestos	221	130	NA	NA.
Barite and witherite	408	429	NA	NA.
Boron materials:				
Crude natural borates	9,503	13,982	NA	West Germany 6,476; Netherlands 6,269.
Oxide and acid	423	242	NA	NA.
Bromine	138	412	NA	Netherlands 398.
Cement thousand tons	2,762	2,871	7	Netherlands 1,681; West Germany 364; France 256.
Chalk	64,813	57,203	NA	Netherlands 15,403; West Germany 13,828; Saudi Arabia 7,166.
Clays and clay products (including all refractory brick):				
Crude:				
Bentonite	8,273	11,574	NA	West Germany 5,113; France 4,300.
Kaolin	3,175	20,345	NA	West Germany 17,034; Netherlands 1,818.
Other	3,663	20,661	NA	Netherlands 19,004.
Products:				
Refractory (including nonclay brick)	96,215	107,505	NA	France 51,860; West Germany 23,456; Italy 8,857.
Nonrefractory value, thousands	$53,459	$51,205	NA	West Germany $17,191; Netherlands $15,957; France $9,538.
Cryolite and chiolite	16	50	--	NA.
Diamond:				
Gem:				
Unworked thousand carats	24,564	22,370	NA	United Kingdom 10,733; India 7,279; Switzerland 2,870.
Worked do	3,077	2,875	711	Hong Kong 351; West Germany 308; Switzerland 301.
Industrial:				
Unworked do	8,641	9,140	2,096	United Kingdom 3,010; Ireland 1,559; West Germany 596.
Worked do	9	11	NA	United Kingdom 6; Switzerland 3.
Diatomite and other infusorial earth	3,567	1,350	NA	Netherlands 1,082; France 112.
Feldspar, leucite, nepheline, nepheline syenite	8,543	7,462	NA	Netherlands 7,367.
Fertilizer materials:				
Crude:				
Nitrogenous	9,816	11,999	NA	Italy 6,115; West Germany 4,752.
Phosphatic	14,203	18,434	NA	West Germany 7,179; France 5,500.
Potassic, K_2O content	138	566	--	Netherlands 544.
Manufactured:				
Nitrogenous, N_2 content thousand tons	516	486	5	France 165; West Germany 114.
Phosphatic, P_2O_5 content do	280	276	NA	France 147; West Germany 91.
Potassic, K_2O content do	283	303	NA	France 77; Norway 42; Netherlands 19.
Other including mixed do	1,641	1,728	NA	France 907; West Germany 281; United Kingdom 70.
Ammonia	84,791	94,507	NA	France 86,947.
Fluorspar	4,540	4,984	--	West Germany 4,813.
Graphite, natural	68	49	--	NA.
Gypsum and plasters	54,905	97,048	NA	West Germany 48,540; Netherlands 37,795.
Lime	590,408	662,265	NA	Netherlands 565,499; Ivory Coast 3,505.
Magnesite	3,594	4,696	NA	France 2,115; West Germany 241.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destination, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica:				
Crude including splittings and waste	94	160	NA	NA.
Worked including agglomerated splittings	2	(1)	NA	NA.
Pigments, mineral, including processed iron oxide	9,055	11,633	NA	France 7,655; Netherlands 1,095; Iraq 626.
Precious and semiprecious stones:				
Natural, except diamond:				
Unworked grams	6	213	NA	NA.
Worked:				
Gem kilograms	r3,980	2,553	NA	Switzerland 2,170; France 176; West Germany 83.
Industrial do.	(1)	(1)	NA	NA.
Manufactured do.	299	1,695	25	Republic of Korea 1,289.
Pyrite, gross weight	53	522	NA	NA.
Salt and brines	139,471	144,224	NA	France 122,545.
Sodium and potassium compounds, n.e.s.	43,656	53,846	NA	France 11,464; Netherlands 10,300.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	583,981	600,716	NA	Netherlands 549,153.
Slate	4,642	6,278	NA	Netherlands 3,427; West Germany 2,582.
Other	18,908	4,735	NA	NA.
Worked:				
Slate	979	918	NA	West Germany 560; Netherlands 81.
Paving stone and flagstone	11,934	7,407	NA	Netherlands 5,855; France 942.
Other	10,251	12,748	92	West Germany 3,070; Saudi Arabia 2,758.
Dolomite, chiefly refractory grade thousand tons	1,602	1,646	NA	Netherlands 835; West Germany 558; France 47.
Gravel and crushed rock do.	12,284	7,946	NA	Netherlands 4,100; France 3,239.
Limestone, except dimension do.	536	538	--	Netherlands 346; France 191.
Quartz and quartzite do.	10	14	NA	West Germany 7; Netherlands 1.
Sand, excluding metal-bearing do.	2,975	3,104	NA	France 914; Netherlands 785; Italy 363.
Sulfur:				
Elemental, all forms	10,661	11,621	NA	West Germany 4,027; Netherlands 1,307; France 1,042.
Sulfuric acid	125,624	190,805	NA	France 100,734; Netherlands 53,139.
Talc, steatite, soapstone, pyrophyllite	18,286	21,186	NA	West Germany 5,464; United Kingdom 2,832; France 2,821.
Other:				
Crude:				
Vermiculite, perlite, chlorite	1,134	1,338	NA	NA.
Other	151,608	151,478	NA	Netherlands 129,506; France 15,539.
Slag, dross, and similar waste, not metal-bearing thousand tons	2,185	2,181	NA	Netherlands 882; West Germany 750; France 540.
Oxides and hydroxides of magnesium, strontium, barium	194	153	NA	NA.
Iodine and fluorine	8	6	NA	NA.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s thousand tons	1,370	1,784	2	Netherlands 700; United Kingdom 330; France 262.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4,465	9,254	NA	West Germany 8,089; France 739.
Carbon black and gas carbon	947	686	NA	France 212; Netherlands 158; West Germany 110.
Coal and briquets:				
Anthracite and bituminous	245,535	445,248	50,914	West Germany 171,827; France 112,846.
Briquets of anthracite and bituminous coal	25,622	58,927	NA	France 54,246.
Lignite and lignite briquets	8	138	--	NA.
Coke and semicoke	195,843	638,510	238,355	France 177,641; West Germany 108,338.
Gas, natural million cubic feet	1,596	7	NA	NA.
Hydrogen, argon, rare gases	39,981	43,100	NA	France 24,200; West Germany 13,382.
Peat including peat briquets and litter	1,984	4,394	NA	Netherlands 2,170.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	591	62	NA	Netherlands 59.

See footnotes at end of table.

Table 2.—Belgium-Luxembourg: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destination, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Gasoline and white spirit thousand 42-gallon barrels	r34,515	36,280	NA	West Germany 9,048; Netherlands 6,762; Sweden 4,440.
Kerosine ——do	r8,263	9,763	NA	West Germany 2,517; Netherlands 1,053; Nigeria 841.
Distillate fuel oil ——do	r21,475	26,704	NA	West Germany 12,413; Denmark 3,022; Netherlands 2,988.
Residual fuel oil ——do	36,615	29,894	NA	United Kingdom 7,868; Netherlands 6,477; West Germany 3,777.
Lubricants ——do	2,265	2,516	NA	Netherlands 803; West Germany 316; Switzerland 152.
Other:				
Mineral jelly and wax ——do	40	32	NA	France 10; Italy 6; West Germany 5.
Liquefied petroleum gas ——do	2,628	2,781	94	Netherlands 1,214; West Germany 438; France 237.
Nonlubricating oils, n.e.s. do	67	78	NA	Netherlands 49; Saudi Arabia 12.
Bitumen and other residues do	1,296	1,105	NA	Netherlands 642; Sweden 332.
Bituminous mixtures, n.e.s do	98	72	NA	France 28; Netherlands 23; West Germany 9.
Pitch, pitch coke, petroleum coke do	375	348	NA	France 219; West Germany 111.
Unspecified ——do	r679	522	NA	West Germany 61; Netherlands 47; Tanzania 28.
Total ——do	r108,316	110,095		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	276	258	14	West Germany 115; Netherlands 75; France 31.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Valued at $218,050, of which $77,254 went to Switzerland, $59,279 to the United States, and $29,401 to India.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	32,867	40,902	NA	Australia 15,408; Guyana 7,928; West Germany 7,046.
Oxide and hydroxide	21,834	23,869	NA	West Germany 16,467.
Ash and residue containing aluminum	1,582	3,335	NA	West Germany 1,234; France 1,021.
Metal including alloys:				
Scrap	15,351	26,556	5,958	France 7,032; West Germany 4,167; Netherlands 3,638.
Unwrought	266,834	252,770	NA	Netherlands 148,853; West Germany 14,415.
Semimanufactures	75,662	84,328	179	West Germany 34,146; France 19,101; Netherlands 15,767.
Antimony:				
Ore and concentrate	5,178	6,662	NA	Bolivia 3,812; Chile 682; Canada 636.
Oxide and hydroxide	110	240	43	France 164; West Germany 22.
Metal including alloys, all forms	227	335	NA	China, mainland 323.
Beryllium:				
Oxide and hydroxide ——kilograms	4,100	300	--	NA.
Metal including alloys, all forms ——do	[1]200	([2])	NA	NA.
Cadmium metal including alloys, all forms	1,032	1,166	NA	West Germany 274; Japan 220; Italy 145.
Chromium:				
Chromite	2,309	1,903	NA	Netherlands 1,634; United Kingdom 12.
Oxide and hydroxide	524	570	NA	West Germany 452.
Metal including alloys, all forms	909	543	NA	U.S.S.R. 340; West Germany 85.
Cobalt oxide and hydroxide	66	54	--	France 26; Netherlands 15; United Kingdom 13.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Copper:				
Ore and concentrate	5,485	1,774	--	Australia 774; Morocco 645; Canada 350.
Copper sulfate	1,075	1,233	NA	U.S.S.R. 480; France 422; Netherlands 181.
Ash and residue containing copper	24,601	26,803	7,563	France 10,756; United Kingdom 508.
Oxide and hydroxide	22	36	--	NA.
Metal including alloys:				
Scrap	64,993	100,384	14,632	France 27,032; Netherlands 18,486; United Kingdom 9,475.
Unwrought	560,151	518,510	NA	Zaire 261,504; Republic of South Africa 31,461; Zambia 27,581.
Semimanufactures	50,381	49,046	179	West Germany 31,415; France 4,289.
Gold:				
Waste and sweepings, value, thousands	$919	$1,224	NA	Netherlands $720; United Kingdom $253.
Metal, worked or partly worked, thousand troy ounces	1,687	781	107	Switzerland 455.
Iron and steel:				
Ore and concentrate, except roasted pyrite, thousand tons	24,243	26,144	NA	France 7,853; Sweden 6,880; Brazil 3,661.
Roasted pyrite, do.	215	184	--	West Germany 134.
Metal including alloys:				
Scrap, do.	980	970	21	West Germany 378; Netherlands 245; France 214.
Pig iron including cast iron, do.	119	105	NA	France 58; West Germany 19; Brazil 13.
Sponge iron, powder, shot	4,988	8,034	NA	West Germany 2,074; France 1,926; Netherlands 882.
Spiegeleisen	407	173	--	NA.
Ferroalloys, thousand tons	164	193	NA	France 52; Norway 52; West Germany 35.
Steel, primary forms, do.	1,076	1,168	4	Netherlands 277; West Germany 163; Spain 124.
Semimanufactures:				
Bars, rods, angles, shapes, sections, do.	875	884	NA	France 328; West Germany 201; Netherlands 102.
Universals, plates, sheets, do.	685	557	(3)	Netherlands 162; France 151; West Germany 94.
Hoop and strip, do.	151	143	1	France 76; West Germany 29.
Rails and accessories, do.	38	45	NA	France 32; West Germany 10.
Wire, do.	56	40	(3)	West Germany 29; France 10.
Tubes, pipes, fittings, do.	209	223	(3)	West Germany 62; Netherlands 56; France 50.
Castings and forgings, rough, do.	38	61	NA	Netherlands 19; France 18; West Germany 17.
Total, do.	2,052	1,953		
Lead:				
Ore and concentrate	74,541	82,218	NA	Ireland 16,430; Peru 13,925; Greece 12,883; Australia 10,289.
Ash and residue containing lead	42,919	70,557	18,591	West Germany 16,549; France 8,515; United Kingdom 6,490.
Oxide	1,364	1,309	NA	France 682; West Germany 504.
Metal including alloys:				
Scrap	14,593	12,632	168	Netherlands 8,029; West Germany 1,252; France 870.
Unwrought	56,394	57,800	NA	France 15,424; United Kingdom 3,480; West Germany 3,285.
Semimanufactures	2,584	3,438	NA	West Germany 2,474; Netherlands 669.
Magnesium metal including alloys:				
Scrap	110	178	NA	West Germany 65; Lebanon 49.
Unwrought	1,702	1,252	361	Netherlands 407; France 241.
Semimanufactures	464	440	148	West Germany 167; Switzerland 36.
Manganese:				
Ore and concentrate	252,842	432,140	NA	Republic of South Africa 218,810; Congo 108,533; Ghana 400.
Oxide	2,252	3,350	741	Greece 1,478; Ireland 768.
Metal including alloys, all forms	522	1,133	129	Republic of South Africa 729; Netherlands 79.
Mercury, 76-pound flasks	2,785	3,481	NA	Italy 1,015; Spain 522; United Kingdom 522; Finland 406.
Molybdenum:				
Ore and concentrate	13,381	15,856	3,054	Canada 5,600; Chile 4,828; West Germany 1,311.
Oxide and hydroxide	331	28	NA	West Germany 26.
Metal including alloys, all forms	332	189	NA	Netherlands 130; United Kingdom 19; France 16.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Ore and concentrate	--	79	78	NA.
Oxide and hydroxide	136	402	--	Australia 187; France 82; Sweden 58.
Matte, speiss, similar materials	401	177	NA	Netherlands 87; Australia 50; Republic of South Africa 26.
Metal including alloys:				
Scrap	1,072	753	18	France 253; Netherlands 162; West Germany 119.
Unwrought	3,066	4,250	1,204	Republic of South Africa 951; U.S.S.R. 644; Cuba 385.
Semimanufactures	2,034	1,488	188	West Germany 752; France 168; United Kingdom 159.
Platinum-group metals including alloys, all forms ---- thousand troy ounces	88,506	83,965	NA	United Kingdom 44,259; West Germany 23,390.
Selenium, elemental ---- kilograms	6,500	23,800	3,000	West Germany 4,600; Japan 2,900; United Kingdom 1,600.
Silver metal including alloys, all forms thousand troy ounces	28,482	25,365	10,338	Netherlands 5,318; Poland 2,032; West Germany 825.
Tin:				
Ore and concentrate	4,718	2,912	NA	Zaire 1,923; Rwanda 795.
Metal including alloys:				
Scrap	131	175	14	Netherlands 130.
Unwrought	2,233	2,793	NA	Malaysia 940; Netherlands 553; Zaire 379; United Kingdom 217.
Semimanufactures	343	268	NA	Netherlands 93; West Germany 68; France 43.
Titanium:				
Ore and concentrate	36,979	26,577	NA	Canada 20,554; West Germany 5,932.
Oxide	12,674	9,742	1,524	West Germany 3,301; United Kingdom 1,600; France 1,492.
Metal including alloys, all forms	1,462	4,097	1,235	West Germany 84; United Kingdom 48.
Tungsten:				
Ore and concentrate ---- kilograms	--	100	--	NA.
Oxide and hydroxide	6	35	NA	West Germany 15.
Metal including alloys, all forms	199	299	NA	West Germany 137; Netherlands 106.
Uranium metal including alloys, all forms value, thousands	$7,572	--		
Vanadium oxide	NA	1,169	NA	Republic of South Africa 732; Netherlands 241.
Zinc:				
Ore and concentrate	532,471	554,133	NA	Canada 277,644; Ireland 60,377; Peru 54,236.
Oxide and peroxide	7,308	7,276	NA	France 2,636; Netherlands 2,091; United Kingdom 1,212.
Ash and residue containing zinc	57,020	66,673	9,260	West Germany 22,388; France 14,015; Netherlands 7,048.
Metal including alloys:				
Scrap	5,551	6,648	372	France 2,537; Netherlands 1,530; West Germany 618.
Blue powder	936	1,166	--	Netherlands 741; West Germany 292.
Unwrought	24,928	51,484	10,534	Netherlands 17,009; Canada 8,120; West Germany 6,454.
Semimanufactures	19,207	20,730	NA	France 19,638.
Other:				
Ores and concentrates:				
Of niobium, tantalum, vanadium, zirconium	3,681	4,472	1,185	Canada 949; Netherlands 932; Australia 588.
Of precious metals	55	20	(3)	Spain 19.
Of base metals, n.e.s	67,751	94,355	NA	Canada 46,916; Republic of South Africa 21,764; Norway 17,046.
Ash and residue containing nonferrous metals, n.e.s	68,489	38,317	2,471	Peru 10,072; Netherlands 8,903; West Germany 4,640.
Waste and sweepings of precious metals, n.e.s ---- value, thousands	$8,849	$80,875	$65,543	United Kingdom $10,589; Netherlands $2,060.
Oxides, hydroxides, peroxides of metals, n.e.s	r786	776	14	West Germany 538; France 164; Netherlands 38.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Metals including alloys, all forms:				
Metalloids:				
Tellurium and arsenic	73	115	--	Sweden 111; U.S.S.R. 4.
Other	8,538	3,782	141	France 2,880.
Alkali, alkaline-earth, rare-earth metals	125	124	NA	France 50; West Germany 22; Austria 10.
Pyrophoric alloys kilograms	1,300	800	NA	NA.
Base metals including alloys, all forms, n.e.s	216	128	92	France 10; West Germany 10.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	57,258	37,261	NA	West Germany 35,770.
Dust and powder of precious and semiprecious stone, natural and manufactured including diamond kilograms	3,467	2,262	938	Ireland 580.
Grinding and polishing wheels and stones	2,818	3,441	11	West Germany 873; Austria 796; Netherlands 404.
Asbestos	51,037	50,754	1	Canada 19,154; Republic of South Africa 7,793.
Barite and witherite	8,292	8,082	NA	France 5,927.
Boron materials:				
Crude natural borates	31,956	31,028	1,831	Turkey 12,566; Netherlands 10,710.
Oxide and acid	2,164	1,899	NA	France 1,530.
Bromine	249	828	NA	Israel 732.
Cement	357,398	297,440	NA	West Germany 151,200; Netherlands 88,113; France 50,183.
Chalk	111,321	109,712	NA	France 87,032.
Clays and clay products:				
Crude:				
Bentonite	28,628	24,553	3,992	Netherlands 6,277; Greece 4,756; West Germany 3,836.
Kaolin	289,598	290,084	NA	West Germany 92,489; United Kingdom 83,891.
Other	230,732	230,842	9,216	West Germany 152,540; France 26,010; Netherlands 24,597.
Products:				
Refractory (including nonclay brick)	145,084	173,009	785	West Germany 97,803; France 23,413.
Nonrefractory value, thousands	$141,377	$155,868	NA	West Germany $48,270; Italy $46,055; Netherlands $27,125.
Cryolite and chiolite	83	61	--	NA.
Diamond except powder:				
Gem:				
Unworked thousand carats	26,190	24,864	NA	United Kingdom 17,651.
Worked do	2,525	2,225	84	India 817; U.S.S.R. 272; Israel 228; Republic of South Africa 165.
Industrial:				
Unworked do	10,181	11,308	1,652	Ireland 2,321; United Kingdom 2,074; Congo 1,974.
Worked do	2	1	NA	Mainly from Switzerland.
Diatomite and other infusorial earth	9,607	11,348	1,128	France 6,226; Denmark 2,156; Spain 1,508.
Feldspar, leucite, nepheline syenite	64,404	67,186	NA	Norway 30,776; France 28,231.
Fertilizer materials:				
Crude:				
Nitrogenous	21,026	24,613	NA	Chile 22,438.
Phosphatic thousand tons	1,941	2,155	151	Morocco 1,320; Togo 113.
Potassic, K_2O content	8,419	10,827	--	France 5,475; West Germany 5,325.
Manufactured:				
Nitrogenous, N_2 content	151,472	155,763	37,460	West Germany 47,698; Netherlands 24,980; France 24,128.
Phosphatic, P_2O_5 content	90,037	77,202	55,497	Morocco 4,733; Netherlands 3,154; Tunisia 2,473; France 1,102.
Potassic, K_2O content	577,387	613,329	NA	West Germany 342,189; France 72,821; U.S.S.R. 32,804.
Other including mixed	481,934	517,062	237,202	West Germany 85,794; France 76,632; Portugal 18,684.
Ammonia	2,368	2,707	NA	West Germany 1,555; Netherlands 1,055.
Fluorspar	9,953	14,549	--	France 6,623; Mexico 3,940; Netherlands 1,684.
Graphite, natural	3,959	1,842	432	Norway 387; West Germany 251; Madagascar 154.
Gypsum and plaster	513,081	387,716	NA	France 346,462.
Lime	146,887	130,228	NA	France 114,333; West Germany 12,105.
Magnesite	24,268	24,204	584	Italy 5,858; Netherlands 3,644; United Kingdom 3,253.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica:				
Crude including splittings and waste	3,630	1,803	NA	United Kingdom 473; France 353; Netherlands 108.
Worked including agglomerated splittings	36	56	NA	Switzerland 20; West Germany 3.
Pigments, mineral, including processed iron oxide	6,903	8,030	NA	West Germany 6,438.
Precious and semiprecious stones except diamond:				
Natural:				
Unworked grams	129	201	NA	NA.
Worked:				
Gem do	r18,476	6,267	NA	France 447; West Germany 332; India 274; Hong Kong 270.
Industrial kilograms	53	413	44	Republic of Korea 266.
Manufactured grams	1,781	3,851	2,536	West Germany 481.
Pyrite, gross weight	202,917	195,210	NA	Spain 194,649.
Salt and brines thousand tons	805	1,219	NA	Netherlands 695; West Germany 418.
Sodium and potassium compounds, n.e.s	r40,800	54,213	NA	West Germany 36,355; Netherlands 10,121; Italy 1,579.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	115,579	121,928	NA	Norway 97,293; France 52,078; Portugal 12,936.
Worked	100,819	103,565	NA	Italy 34,454; France 25,803; West Germany 8,529.
Dolomite, chiefly refractory grade	50,665	46,593	NA	West Germany 22,895; France 18,239.
Gravel and crushed rock thousand tons	7,069	7,409	NA	Netherlands 3,548; United Kingdom 1,488.
Limestone, except dimension do	323	385	NA	United Kingdom 252; Spain 82.
Quartz and quartzite do	142	150	NA	West Germany 122; Sweden 10.
Sand, excluding metal-bearing do	9,934	10,640	NA	Netherlands 9,183.
Sulfur:				
Elemental, all forms	483,809	554,474	348,267	Canada 48,281; France 46,725.
Sulfuric acid	268,975	342,488	NA	West Germany 137,055; France 112,289; Netherlands 88,492.
Talc, steatite, soapstone, pyrophyllite	22,759	36,915	15,342	France 7,480; Australia 5,950.
Other:				
Crude:				
Vermiculite, perlite, chlorite	52,981	58,090	NA	U.S.S.R. 25,716; Greece 24,808; Mozambique 3,484.
Other thousand tons	1,374	1,347	NA	France 1,020; Spain 157; Netherlands 78.
Slag, dross, and similar waste, not metal-bearing do	1,237	1,195	NA	France 991; Netherlands 97; West Germany 84.
Oxides and hydroxides of magnesium, strontium, barium	1,356	1,283	NA	West Germany 432; United Kingdom 249; France 135.
Iodine and fluorine	132	122	NA	Chile 65; West Germany 36.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s thousand tons	876	666	3	West Germany 253; Netherlands 173; Czechoslovakia 70.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	121,669	126,077	271	France 115,498; Netherlands 9,357.
Carbon black and gas carbon	33,802	35,994	1,105	Netherlands 14,618; West Germany 11,934; France 3,572.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	7,659	10,035	2,331	West Germany 3,454; Republic of South Africa 1,843.
Briquets of anthracite and bituminous coal	126,134	133,926	--	West Germany 120,991.
Lignite and lignite briquets	54,727	71,093	--	West Germany 70,505.
Coke and semicoke thousand tons	2,654	3,706	NA	West Germany 3,106.
Gas:				
Manufactured million cubic feet	--	539	--	All from France.
Natural do	410,185	447,876	NA	Netherlands 380,231.
Hydrogen, argon, rare gases	8,263	9,793	241	Netherlands 6,856; West Germany 137.
Peat including peat briquets and litter	142,855	153,165	--	West Germany 72,187; Netherlands 70,659.

See footnotes at end of table.

Table 3.—Belgium-Luxembourg: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude and partly refined:				
Crude _ thousand 42-gallon barrels__	224,809	230,656	NA	Saudi Arabia 115,753; Nigeria 23,122; Iran 17,983.
Partly refined _____do____	r4,319	6,219	NA	Algeria 1,588; Netherlands 931; West Germany 708.
Refinery products:				
Gasoline and white spirit ___do____	r9,436	11,309	NA	Netherlands 6,285; France 1,459; United Kingdom 1,081.
Kerosine _____do____	r183	596	NA	Netherlands 214; Yugoslavia 150; Italy 133.
Distillate fuel oil _____do____	r20,661	32,112	NA	Netherlands 13,296; United Kingdom 10,739; U.S.S.R. 2,912.
Residual fuel oil_____do____	30,824	30,698	NA	Netherlands 14,381; U.S.S.R. 4,261; Saudi Arabia 2,569.
Lubricants _____do____	2,721	3,338	NA	Netherlands 1,246; France 885; Italy 524.
Other:				
Mineral jelly and wax __do____	145	151	2	West Germany 79; France 32; Netherlands 13.
Liquefied petroleum gas _do____	4,735	4,886	NA	Netherlands 2,637; West Germany 622; Saudi Arabia 346.
Nonlubricating oils, n.e.s._do____	735	831	169	Netherlands 283; West Germany 189.
Bitumen and other residues do____	563	464	NA	France 282; Netherlands 135.
Bituminous mixtures, n.e.s do____	205	149	8	Netherlands 65; France 55.
Pitch, pitch coke, petroleum coke do____	476	1,525	1,312	United Kingdom 79.
Unspecified_____do____	r142	158	NA	United Kingdom 90; France 26; Netherlands 19.
Total _____do____	r70,826	86,217		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals_____	153,155	116,552	1,011	Finland 25,073; Netherlands 24,271; France 22,122.

rRevised. NA Not available.
[1]This quantity, valued at $4,266, excludes a quantity valued at $1,433.
[2]Value only reported at $36,427.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—Belgium, whose chief sources of copper have traditionally been Zaire and other western nations, signed a contract with Poland, through the Société Generale des Mines and the Polish Impexmetal, to import 42,000 tons of copper by 1984; this continued a contract signed in 1978 for 28,000 tons over 4 years.

Iron and Steel.—The mild recovery in Belgian steel production, which began in 1978 and continued in 1979, was abruptly reversed in 1980, and production fell by about 1 million tons, to somewhat more than 12 million tons. The decline was largely concentrated in the second half of the year. A program of mandatory production cuts was instituted by the European Economic Community (EEC) in the last quarter, and this was generally successful, but the objective of raising prices was not effective throughout the EEC, according to Etienne Davignon, the EEC's Commissioner for Industry.

In spite of reorganization during 1979 and the 44 billion franc ($1.4 billion)[2] investment program approved by the National Commission for Planning and Control in January 1980, to be financed equally by the Government and private steel interests, the steel industry's restructuring plan was not completed in 1980. A sharp drop in orders, short working time, and persistent financial problems continued to plague the industry and to complicate the task of restructuring. The interest of the Belgian Government, both financial and otherwise, continued to

grow.

In September, the Economics Minister, Willy Claes, proposed a series of strong measures to accompany a further short-term financial package of 5 to 7 billion francs ($170 million to $241 million). These included a forced breakup of Cockerill S.A., the major producer in the Liege area; closure of marginal operations in the Charleroi area by the end of 1980; and recognition of their responsibilities by the private financial interests in the steel industry. The steps were proposed amid reports that the steel industry was losing 1,500 to 2,000 francs ($50 to $70) on each ton of steel, and that the purpose of the breakup of Cockerill was to isolate money-losing operations.

The Government later the same month approved its share of the economic assistance, amounting to 22.9 billion francs ($789 million), while dropping for the moment the attempt to break up Cockerill; apparently it still intended to encourage the private investors in the steel industry to contribute to meeting the cost of restructuring.

At the end of the year, reorganizations and mergers, along with recent Government financial aid, had resulted in the following alignment of the major raw steel producers in Belgium and Luxembourg:

	Approximate production 1979 (million tons)	Percent held by Belgian Government	Percent held by private holding companies	Percent held by others
Cockerill S.A.	4.0	28.9	[1]19.3	51.8
Hainaut-Sambre S.A.	2.6	30.9	[2]20.6	48.5
Forges de Thy-Marcinelle et Providence, S.A.		42.3	[2]28.2	29.5
Sidmar S.A.	2.8	22.0	[3]2.5	[4]75.5
Arbed (Luxembourg)		[5]14.8	[3]14.8	70.4

[1]Ste. Generale, Fibelpar, Cie. Bruxelles-Lambert.
[2]Cie. Bruxelles-Lambert, Cobepa, Frere-Bourgeois.
[3]Ste. Generale.
[4]Arbed 62%, Union Miniere 7%, Falck 5%.
[5]Empain-Schneider.

Smaller steel producers in Belgium included principally the private Usines Gustave Boel S.A. (1.0 million tons produced in 1979) and the related Fabrique de Fer de Charleroi S.A.; and Forges de Clabecq S.A. (700,000 tons), in which the Belgian Government took a financial interest in October in exchange for assuming its debts.

At the end of 1980, reports circulated in Brussels that the European Commission had notified the Belgian Government that its steel aid plans appeared unacceptable to the EEC, because they would lead to an increase in capacity, even taking into account related closings, and would not make the Belgian industry competitive and able to function without continued aid. With the Government's growing inablity to finance all the demands made on it by the industry, it appeared that 1981 would be a year of significant decisions.

Lead and Zinc.—Belgium's custom smelters, while efficient and modern, are beset by high labor and energy costs, with the result that some smelters found prices much below $1,000 per ton insufficient to make a profit. A shortage of zinc concentrates, especially compared with integrated smelters (owned by mining companies), and the severe competition in third country markets with Canada and Australia, foretold continued surplus capacity, and perhaps some plant closures.

Ste. de Prayon S.A., the third largest Belgian producer of zinc, was reported close to ceasing production of slab zinc, but was expected to continue its zinc products, cadmium production, and other operations. The company lost about 300 million francs (about $10 million) in 1979, and was forced to borrow to continue operations in 1980.

The Ste. des Mines et Fonderies de Zinc de la Vieille Montagne S.A., the largest Belgian zinc producer, brought into full production a new electrolysis hall at its plant at Balen. The automated operations used Super Jumbo cathodes, which were much larger (3.2 square meters of surface) than the Jumbo (2.6 square meters) cathodes that represented a major advance when introduced in 1969. Capacity of the new installation was reported at 110,000 tons per year. During 1980, the company reported a profit of 66 million francs (about $21 million) for 1979 after 2 years of heavy losses.

Minor Metals.—Metallurgie Hoboken-Overpelt S.A. commissioned a hydrometallurgical plant at its Olen works to recover minor products, mainly nickel, copper, cobalt, arsenic, antimony, and precious metals from about 6,000 tons per year of complex substances from its lead and copper metallurgical plants. Some material formerly dumped, as well as material from old dumps, will also be treated, thus benefiting the environment. Final products will be in the form of sodium aluminate, copper, impure nickel sulfate, arsenic trioxide, and sulfuric acid. The end residue was to be sent to the Hoboken plant of the same company for recovery of precious metals. The impure nickel sulfate contained, among other elements, cobalt which will be separated when a new facility comes onstream in 1982. Some 78 jobs were created at the plant, for an investment of 1.3 billion francs (about $40 million).

Tin.—The only tin smelter in Belgium, the 18,000-ton-per-year (tin metal) capacity plant at Hoboken, belonging to Metallurgie Hoboken-Overpelt S.A., was to cease operations at the end of 1980 or early in 1981. The smelter, established in 1908, had been operating at least 25% under capacity for many years, and was producing only about 2,000 tons per year towards the end. The closure was seen as another indication of the transition of tin smelting away from developed countries to tin-mining countries. European smelter tin production has declined from about 30% of world production in 1960 to about 10% in 1980.

NONMETALS

Potash.—Entreprise Miniere et Chimique S.A. (EMC), the French mining and chemicals group which controls the Alsace potash mines, installed a 100,000-ton-per-year compaction unit at each of its three Belgian potassium sulfate plants, to provide for the increasing demand for granulated, rather than pulverized product. Belgium was one of the world's leading producers of potassium sulfate, with about one-quarter of the total. EMC's subsidiaries in Belgium were Produits Chimiques de Limbourg S.A., with a plant at Kwaadmechelen, and Tessenderlo Chemie N.V., with plants at Vilvoorde and Tessenderlo.

MINERAL FUELS

Coal.—A study released by the European Commission of the EEC showed that Belgium metallurgical coal was the most heavily subsidized in the EEC. The subsidy by the Belgian Government was put at 22 Units of Account (UA), equivalent to about $30, per ton of coking coal delivered to EEC steel plants. In the Federal Republic of Germany, the figure was UA16; in France, UA13; and in the United Kingdom, UA3.

Drilling continued at Thulin, the site of the proposed in situ coal gasification project. The Institut National des Industries Extractives (INIEX) announced that the project would cover a 6-year span and cost about $35 million; INIEX had a 51% interest, while Kernforschungsanlagen Julich GmbH of the Federal Republic of Germany had the remaining 49%. It was anticipated that up to 40% of the cost would be contributed by the EEC.

An economic study of coal gasification at the Thulin site was published.[3] The study concluded that production of gas or electricity (from gas) would be competitive with other advanced energy sources under study. It also concluded that drilling expense was the prime element in production cost and that use of oxygen and steam to produce pipeline quality gas was justified because of the wider market.

Natural Gas.—The Ministry of Economic Affairs allocated 320 million francs (about $11 million) for exploratory work and further drilling for natural gas near Havelange, southeast of Namur. Earlier drilling had located an apparently promising deposit in this area, following other drilling at Focant, southeast of Dinant, and at St. Ghislain, near Mons, 2 years before.

Construction delays at the liquefied natural gas terminal being constructed at Zeebrugge to receive Algerian gas caused a postponement of the scheduled completion date from late 1982 to 1985.

Petroleum.—The Belgian Government, in an attempt to insure that the fuel oil shortage experienced by independent dealers in 1979 was not repeated, concluded a deal with Saudi Arabia to buy 13.5 million tons of crude oil, of which 3.5 million were to be purchased in 1980, and 5 million each year in 1981 and 1982, at the Saudi Arabian official price. Belgian independent dealers had been squeezed between rising prices for their traditional Rotterdam spot crude and domestic prices permitted under the agreement between the Government and the Belgian Petroleum Federation to control retail prices.

In the ailing Belgian refining industry (which consisted of eight refineries with a total capacity of about 1 million barrels per day), the U.S. firm, Coastal States Gas Inc., bought the Antwerp refinery of Raffinerie

Belge des Petroles S.A. (92,000-barrel-per-day capacity) for $25 million; the refinery had been closed since August 1978. West German oil distributor, Mabanaft GmbH, also agreed to acquire and modernize the Albatros refinery (also about 92,000-barrel-per-day capacity) owned by Wintershall AG, also near Antwerp, which might involve investments of $120 million.

Uranium.—Umipray S.A., a subsidiary of Société de Prayon S.A. (50%), Union Miniere S.A. (38%), and Metallurgie Hoboken-Overpelt S.A. (12%), was constructing a uranium extraction plant at Sauvegarde, between Antwerp and Brussels; processing was then to be completed at a Prayon subsidiary at Angis and in France. The plant was to use the IMC/Prayon (activated charcoal) process to treat phosphoric acid from Prayon's subsidiary, Chemie Rupel N.V. By 1985, Umipray was expected to supply Synatom S.A., the Belgian nuclear power company, with about 250 tons per year of yellow cake, or about 25% of Belgium's projected consumption.

Union Miniere, in cooperation with Société des Mines et Fonderies de la Vieille Montagne S.A. and Compagnie Royale Asturienne des Mines S.A., began prospecting for uranium in the Province of Liege.

Four nuclear powerplants operated in Belgium in 1980: the BR-3 Mol, 11.5 megawatts electrical (MWe), which started in 1962; Doel-1, 410 MWe, 1974; Tihange-1, 920 MWe, 1975; and the Doel-2, 410 MWe, 1975. Total net generation of electricity in Belgium amounted to 54 million megawatt-hours in 1980, of which nuclear energy provided about 22%.

LUXEMBOURG

Iron and Steel.—Iron and steel production by Acieries Reunies de Burbach-Eich-Dudelange S.A. (Arbed) accounted for about 20% of the GNP of Luxembourg and 70% of its industrial employment. Other production of metals and minerals is minor. Arbed operates steel plants at four major sites in southern Luxembourg: Esch-Belval, Esch-Schifflange, Dudelange, and Differdange. Although iron ore mining is now relatively unimportant, European ore from neighboring countries, such as France, provides a significant share of Arbed's supply.

Arbed had made good progress in fulfilling its steel investment plan in 1979, but in 1980, the world steel crisis made the plan appear too ambitious, and revisions were instituted. As temporary measures, a blast furnace at Dudelange, closed for the summer, was not reopened, cutbacks were made in the output of the medium section mill at Esch-Belval and short-time working was adopted at several plants. Arbed's plans for an intermediate mill at Esch-Belval and a cold-rolling mill at Dudelange were reconsidered. By late 1980, plans called for expenditures of about 23.2 billion francs (around $790 million) for new facilities including 3 billion francs ($100 million) for the cold-rolling mill at Dudelange and the second of two 50,000-ton-per-month continuous slab casters at Esch-Schifflange, where it would feed the hot rolling mill at Dudelange; the first hot mill started up in November.

Arbed's financial position deteriorated during the year, and a loss of about 1 billion francs was anticipated for all operations both within Luxembourg and outside. The Luxembourg Government was thus necessarily involved in financing the investment plan; agreement on assistance of about one-third of the 23.2 billion francs needed was tentatively reached by a tripartite commission composed of representatives from the Government, the labor unions, and the steel industry. This was lower than the 10.8 billion francs requested by Arbed, and might mean a further cutback in investment, according to the company.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Values have been converted from Belgian francs (BF) at the average rate of BF29.0=US$1.00 for 1980; it declined somewhat throughout the year.

[3]Markus, K., and J. Medaets. Etude Economique de la Gazeification Souterraine du Charbon. Ann. des Mines, Brussels, No. 5, May 1980, pp. 465-479.

Table 4.—Luxembourg: Production of mineral commodities[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Iron and steel:					
Iron ore and concentrate	2,079	1,537	835	630	600
Pig iron (including blast furnace ferroalloys)	3,756	3,568	3,721	3,802	[3]3,569
Steel:					
Crude	4,566	4,329	4,790	4,950	[3]4,618
Semimanufactures	3,592	3,468	3,800	3,931	3,900
NONMETALS					
Cement, hydraulic	299	291	311	318	310
Gypsum and anhydrite, crude tons	1,690	2,693	990	1,044	1,000
Phosphates: Thomas slag, gross weight	733	713	771	730	700
Sand and gravel:					
Foundry sand tons	1,500	4,942	2,771	1,400	1,500
Other sand, except glass sand	729	638	615	747	700
Gravel	208	183	213	229	200
Stone:					
Construction:					
Crushed thousand cubic meters	776	778	715	745	700
Dimension:					
Rough cut do	7	6	7	4	4
Facing thousand square meters	1	5	3	4	4
Finished cubic meters	86	6	72	90	90
Flagstone:					
Polished square meters	6	5	4	4	4
Rough tons	1	1	1	(4)	--
Paving stone thousand pieces	6	13	14	--	--
Slate slabs do	1,743	1,383	1,363	1,171	1,000
Industrial:					
Dolomite	387	407	271	294	270
Limestone tons	NA	NA	169,036	140,950	140,000
Quartz, quartzite, glass sand do	18,115	9,940	20,550	79,600	70,000
MINERAL FUELS AND RELATED MATERIALS					
Manufactured gas: Blast furnace gas (0.026 teracalorie per million cubic feet) million cubic feet	264,808	[e]247,000	217,000	213,000	200,000

[e]Estimated. [p]Preliminary. NA Not available.

[1]Table includes data available through June 23, 1981.

[2]In addition to the commodities listed, refractory clays and manufactured phosphatic fertilizers other than Thomas slag are produced, but data are not published and information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Less than 1/2 unit.

The Mineral Industry of Bolivia

By Orlando Martino[1]

Political instability and labor unrest continued to impact upon the Bolivian economy. The downtrend in economic growth that began in 1977 continued into 1980 so that Bolivia was not able to meet the target of 7%-per-year growth specified in the 5-year development plan, 1976-80. In real terms, the economy in 1980 grew by just under 1% to an estimated $4.9 billion.[2] The rate of inflation increased to 47%, the highest of recent years.

The mineral industry contributed about 7% of the gross domestic product (GDP) in 1980. Bolivia's export sector continued to be dominated by its mineral industry. Exports of minerals and mineral fuels in 1980 accounted for almost 86% of foreign exchange earnings to a record high of $887 million. This increase reflects higher world commodity prices since the volume of production and exports in 1980 was generally disappointing. The downtrend in tin output was not reversed in 1980 as earnings from tin exports fell for the first time in recent years.

In 1980, Bolivia continued as an important world producer of tin, antimony, and tungsten and a notable producer of silver, zinc, and lead. In 1979 and 1980, Bolivia ceased to be one of the leading producers of bismuth in response to weakened world demand. Although small in terms of volume, exports of natural gas to Argentina were very important to Bolivia's economy, ranking second after tin. There was limited response in production during the year to higher mineral prices. Declining yields in the more depleted mines were being extracted at higher labor and energy costs. A low level of mine development and exploration to increase reserves continued to characterize both the State mining sector and most of the private sectors. There was also concern in the Bolivian mining community that tin prices might be depressed by authorized sales from the tin stockpile of the U.S. General Services Administration.

State-owned Corporación Minera de Bolivia (COMIBOL), established in 1952, continued as Bolivia's major mineral producing corporation. Operating through 12 subsidiary mining companies, two mixed cooperatives, and several leased small mines, COMIBOL is Bolivia's leading producer of tin, silver, tungsten, zinc, and lead. During 1980, its subsidiaries were engaged in a variety of projects to increase mine productivity and safety, improve milling operations, recover metal values in tailings, and increase reserves.

COMIBOL was preparing a 5-year (1981-85) investment program estimated at $450 million covering exploration, mine rehabilitation, metallurgical projects, civil works, as well as management improvement and technical training. This comprehensive proposal will be studied by outside consultants under a $1.5 million loan granted to COMIBOL by the United Nations Development Program (UNDP). COMIBOL initiated negotiations with the World Bank as a possible source of financing. Bolivia's political instability was reflected in COMIBOL's management. During 1978-80, the general manager was changed eight times, each introducing different administrative and policy directions.

The National Association of Medium Miners (NAMM), comprised of 23 private companies, produced about 25% of the value of nonfuels mineral output in 1980. NAMM was the leading producer of antimony and the second most important producer of tin, tungsten, zinc, lead, and silver. In

spite of favorable market prices in recent years, mineral production by this group has not changed significantly except for antimony and tungsten. The causal factors analyzed by NAMM include (a) political instability and worker unrest, (b) exhaustion of mineral reserves, (c) higher production costs, (d) lack of incentives for new investments and exploration, (e) deficient mill recovery, (f) management problems, and (g) excessive tax burdens. The NAMM group employed about 7,800 workers compared with 26,500 workers employed by COMIBOL.

State-owned Empresa Nacional de Fundiciones (ENAF) was responsible for practically all the smelting and refining activity in Bolivia—particularly tin and antimony. ENAF achieved a record high in output from its high-grade tin smelter at Vinto and approached full utilization of its 20,000-ton-per-year capacity. In 1980, ENAF started its 10,000-ton-per-year low-grade smelter, giving Bolivia a capacity to process all of its tin concentrate.

The State oil company Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) did not reverse the downtrend in petroleum production in 1980, and Bolivia was close to losing its self-sufficiency in oil that it has enjoyed since the early 1950's. Output of natural gas, on the other hand, continued to increase. YPFB has proposed a new 5-year development plan to reverse the decline in liquids production. YPFB did not sign any new operations contracts with foreign oil companies in 1980. Only two foreign companies remain holding operations contracts for oil exploration and development: Occidental Boliviana Inc., a subsidiary of Occidental Petroleum Corp., and Tesoro Bolivia Petroleum Co. in a joint venture with Zapata Exploration Co. and Canadian Superior Oil Ltd. Several U.S. firms indicated an interest in future contracts depending upon improved terms and market shares of any future gas sales to Brazil. The oil and gas sector in 1980 contributed 2.7% of the GDP and almost 24% of the value of exports.

Government Policies and Programs.—The mining industry did not succeed in meeting the production goals set by the Government's 5-year development plan that ended in 1980. During 1978-1980, seven different ministers held office at the Ministry of Mines and Metallurgy. Despite these changes in executives, no major policy changes occurred in the mining sector.

The Ministry completed a review of the proposed Mining Development Law that included a study on mining taxation and recommended reforms to the current Mining Code. In early 1980, the Ministry was expected to present for Government consideration a Mining-Metallurgy Policy for the decade 1981-90.

To stimulate investment in the mining industry, on March 5, 1980, a long-awaited supreme decree was signed, Supreme Decree No. 17248, abolishing the special export tax created in 1972 and establishing a new mining tax (royalty) schedule. The new rate is 53% (formerly 38%) on the presumptive profit, charged on the selling price minus a Government-set presumptive mining cost. The presumptive cost is calculated on available data on costs, but does not always reflect the real cost—sometimes it is higher and other times it is lower. The presumptive tin cost is to vary with any change in the floor price of the buffer stock of the International Tin Council (ITC). In early 1981, the Government was expected to raise the presumptive mining cost schedule by an average of 18%. Under this new schedule, the presumptive cost for tin for COMIBOL would be $4.48 per pound.

Two supreme decrees were signed during 1979 to encourage mechanization and modernization of producing mines with some economic incentives (Supreme Decree Nos. 16414 and 16618). These decrees have been little utilized by the Mining Sector.

Bolivia's position in the ITC did not change, and it maintained its usual hard line on periodic reviews of buffer-stock floor and/or ceiling prices. Regular meetings with other tin producing countries' representatives were held in La Paz and Southeast Asia aimed at organizing a solid front of the tin producing countries. Bolivia's stand on the floor and ceiling price range issue is that such prices should be related to current tin market prices as opposed to the consumers stand that would maintain the price ranges according to production costs.

Several projects were under the direct control of the Ministry of Mines and Metallurgy. The Mining Accounting Project was started to develop an appropriate accounting system for each of the different sectors of the mining industry. Under current legislation, only COMIBOL and the medium miners are compelled to keep books. The project has selected 3 mining companies, out of 20, as pilot units for data research. The World Bank is financing this project.

The Usage of Geothermal Resources project started in 1975 and financed by the Italian Government, concluded its third phase of operations in 1979, with shallow diamond drilling in the areas of Empexa and Laguna Colorada (Department of Potosí). The Italian firm AQUATER was directly in charge of the project. Results obtained so far are very encouraging.

Preliminary studies on the Cotagaita, Tumusla, Tupiza, Blanco, Quechisla, and Arque-Caine Rivers, all draining and running through mining districts, described the lack of waste control on waters used by the mine mills and the urgent need for an environmental protection law.

In June 1980, the World Bank approved a $50 million loan to Bolivia to support a program of economic recovery and structural adjustment. This was the first structual adjustment loan to a Latin American nation. Part of the loan is to finance technical studies on mining tax reforms, and it is also designed to help Bolivia formulate and adopt more export-oriented long-term development strategy based on selective action in the agricultural and mining sectors.

PRODUCTION

Despite political instability and some labor unrest during 1980, mineral output generally rebounded from the depressed levels of 1979. The significant increases in metallic antimony and tin reflect better utilization of installed smelter and/or refinery capacity. On the other hand, mine output of tin dropped to a new low relative to recent years. The notable increase in gold output indicates a strong response to the recent surge in world prices.

Although production of natural gas continued its gradual upward trend; output of crude petroleum and condensate remained in a serious downtrend since the peak year of 1973. In both 1979 and 1980, oil output decreased 14%.

COMIBOL's chief mineral output, summarized in table 2, came primarily from over 90 mines organized under 12 mining companies. Tin output by COMIBOL declined again to the lowest level since 1968. A record high was achieved in tungsten output, and a notable rebound occurred in lead production.

As shown in table 3, the medium miner's group produced a record level of antimony. Its silver output increased sevenfold since 1976—reflecting the growth in lead and zinc output. In 1979, the medium miner's share of Bolivia's total output was antimony—81%, tungsten—49%, zinc—38%, cadmium—25%, lead—23%, tin—21%, and silver—13%.

Table 1.—Bolivia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS[3]					
Antimony:					
Mine output, metal content	17,015	r16,340	13,337	13,019	15,465
Metal	41,744	r1,431	2,391	2,500	5,099
Arsenic, mine output, white arsenic equivalent[e]	5	NA	--	--	--
Beryllium: Beryl ore (10%-12% BeO)[4]	e30	--	--	--	--
Bismuth:					
Mine output, metal content	612	r651	307	10	11
Metal	r398	r586	292	--	41
Cadmium, mine output, metal content[5]	142	r150	93	90	173
Copper, mine output, metal content	5,100	r3,191	2,853	1,797	1,884
Gold, mine output, metal content[6] troy ounces	41,540	24,293	24,660	30,319	52,075
Iron ore:[4]					
Gross weight	--	r6,800	55,450	25,000	5,600
Metal content	--	r4,328	35,313	15,900	3,570
Lead:					
Mine output, metal content	16,386	18,937	18,039	15,359	17,747
Metal including alloys	--	r75	489	588	500
Manganese ore:					
Gross weight[e]	12,265	8,586	1,237	10,500	4,500
Metal content	3,680	2,576	371	3,150	1,350
Silver, mine output, metal content thousand troy ounces	r5,340	r5,813	6,285	5,742	6,099

See footnotes at end of table.

Table 1.—Bolivia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS[3] —Continued					
Tin:					
Mine output, metal content	30,315	r33,740	30,881	27,648	27,272
Metal, smelter	r9,790	r13,045	16,254	14,950	18,191
Tungsten, mine output, metal content	3,182	r3,063	3,073	3,114	3,359
Zinc, mine output, metal content	48,546	61,406	53,923	51,621	50,260
NONMETALS					
Barite	[4]917	r [4]2,157	[4]2,889	[4]2,228	8,694
Calcite	--	--	--	--	302
Cement, hydraulic	220,293	266,876	254,254	251,000	e260,000
Feldspar-related minerals: Sodalite	[4]2	6	NA	NA	--
Gypsum, crude	e1,000	e1,000	e1,000	e1,000	1,200
Magnesite[4]	80	--	--	--	--
Salt[e]	10,000	10,000	10,000	10,000	10,000
Sulfur	r14,384	r6,276	14,229	15,000	11,244
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross—million cubic feet	153,968	149,075	154,769	157,090	168,830
Marketable—do	71,442	70,536	61,297	70,237	78,644
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	43	43	40	--	--
Liquefied petroleum gas—do	462	643	815	820	e850
Petroleum:					
Crude—do	14,856	12,676	11,844	10,174	8,704
Refinery products:					
Gasoline—do	2,453	2,649	4,133	4,472	3,684
Jet fuel—do	406	485	605	541	713
Kerosine—do	1,078	1,050	1,169	1,033	1,021
Distillate fuel oil—do	1,363	1,679	1,847	1,830	1,587
Residual fuel oil—do	1,353	1,500	1,525	720	97
Lubricants—do	76	88	100	156	181
Other:					
Liquefied petroleum gas—do	1,046	1,729	292	355	550
Unspecified—do	NA	NA	36	[7]1,771	[7]1,892
Refinery losses[8]—do	171	127	108	73	52
Total—do	7,946	9,307	9,815	10,951	9,777

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 16, 1981.

[2]In addition to the commodities listed, salt and a variety of crude construction materials (clays; crushed, broken, and dimension stone; and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-scale mines.

[4]Data represent exports and are regarded as being virtually equal to production.

[5]Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

[6]COMIBOL output plus sales by placer mines. (Small- and medium-scale mines cannot legally export gold.)

[7]Includes topped crude (presumably further processed outside of refineries reported in this table, or used without further processing) as follows, in thousand 42-gallon barrels: 1979—669; and 1980—481.

[8]Refinery fuel not reported separately, if at all, in recorded data.

Table 2.—Bolivia: COMIBOL's total mineral output

(Metric tons of fine content unless otherwise specified)

Commodity	1976	1977	1978	1979	1980	Percent change, 1979-80
Bismuth	536	631	305	382	11	-97
Cadmium	140	138	108	128	134	+5
Copper	3,415	3,643	2,733	1,764	1,797	+2
Gold—troy ounces	354	492	9,480	NA	NA	--
Lead	12,556	14,366	12,646	9,551	10,953	+15
Silver—thousand troy ounces	4,951	5,433	5,700	4,938	5,118	+4
Tin	20,626	23,306	21,443	19,011	18,671	-2
Tungsten (WO_3)	1,121	1,056	988	1,355	1,576	+16
Zinc	34,046	35,190	38,639	30,120	29,953	-1

NA Not available.

Table 3.—Bolivia: Principal minerals produced by the medium miners

(Metric tons of fine content unless otherwise specified)

	1976	1977	1978	1979	1980	Percent change, 1979-80
Antimony	10,937	9,868	8,801	10,589	11,552	+9
Lead	712	2,186	3,308	3,467	3,994	+15
Silver thousand troy ounces	97	378	550	740	664	-10
Tin	6,924	6,967	6,537	5,930	5,899	-1
Tungsten	1,557	1,602	1,677	1,504	1,558	+4
Zinc	11,031	26,097	19,263	16,728	16,748	--

TRADE

By 1980, the value of mineral exports projected in the Government's 5-year economic plan (1976-80) was surpassed mainly because of significant increases in world prices of tin, silver, and tungsten. On the other hand, the projected volume of production and exports was not achieved.

As shown in table 5, the value of mineral exports was at a record high in 1980, primarily because of higher world prices. However, the volume of mineral exports was generally lower than in 1978 and 1979, with the exception of tungsten which increased 30% in volume and 35% in value. Although the volume of silver exports decreased slightly, the export value more than doubled because of sharply higher prices.

The volume of tin exports dropped 12%. Its value also declined (despite high tin prices), reversing a rising trend since 1976. The relative importance of tin in Bolivia's export sector also decreased—almost 37% in 1980 relative to 47% in 1979. Tin exports in 1980 were distributed as follows: By smelters as refined tin—14,218 tons, as concentrate by COMIBOL—4,991 tons, medium miners—1,036 tons, and small miners—2,285 tons, through The Banco Minero (BAMIN). Exports of minerals and mineral fuels in 1980 accounted for almost 86% of the country's total.

Excluding sales of concentrate to ENAF, the value of COMIBOL's exports in 1980 (chiefly tin, silver, tungsten, zinc, and lead) amounted to $238 million or 37% of total mineral exports. COMIBOL's export earnings increased 21% in 1980 mainly because of silver and tungsten.

For the second year, exports of natural gas exceeded exports of petroleum (white gasoline). Since 1975, natural gas has been Bolivia's second most valuable export after tin. Exports of natural gas, currently to Argentina, will become even more important when the proposed gas pipeline to São Paulo, Brazil, is completed. Because of declining crude oil output, Bolivia was expected to have to import petroleum products in 1981, especially diesel, fuel oil, and lubricants.

Table 4.—Bolivia: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	1980	Destinations, 1979	
				United States	Other (principal)
METALS					
Antimony:					
Ore and concentrate	8,330	16,584	12,622	NA	NA.
Metal, alloyed	2,197	52	1	NA	NA.
Total	10,527	16,636	12,623	14,565	Netherlands 483; Brazil 329; Venezuela 325.
Bismuth:					
Ore and concentrate	14	NA	NA	--	NA.
Metal, alloyed	117	NA	NA	--	NA.
Total	131	46	547	--	Belgium 44; Colombia 2.
Cadmium in zinc ore and concentrate	93	8	--	8	
Copper ore and concentrate	2,990	1,740	1,676	NA	NA.
Gold metal including alloys, all forms troy ounces	66	--	--		
Iron ore and concentrate	r35,313	2,628	--	NA	NA.

See footnotes at end of table.

Table 4.—Bolivia: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	1980	Destinations, 1979	
				United States	Other (principal)
METALS —Continued					
Lead:					
Ore and concentrate	16,482	15,634	15,936	7,964	NA.
Metal, alloyed	86	242	276	NA	NA.
Manganese ore and concentrate	r370	29	425	NA	NA.
Silver ore and concentrate thousand troy ounces	r6,356	5,832	5,684	3,009	NA.
Tin:					
Ore and concentrate	13,818	NA	NA	2,511	NA.
Smelter products	14,198	NA	NA	6,340	U.S.S.R. 2,873; Netherlands 2,109; Czechoslovakia 912.
Anodic	1,263	NA	NA	NA	NA.
Total	29,279	25,659	22,530	NA	NA.
Metal, alloyed:					
Crude	419	NA	NA	NA	NA.
Other	197	NA	NA	NA	NA.
Total	616	1,686	721	616	West Germany 497; United Kingdom 195; Colombia 129.
Tungsten ore and concentrate	r2,851	2,647	3,435	1,379	NA.
Zinc ore and concentrate	r51,622	53,934	46,237	24,751	NA.
Other metals, alloyed	--	--	78		
NONMETALS					
Barite	2,889	2,228	8,649	NA	NA.
Gypsum	1,000	NA	1,200	NA	NA.
Stone:					
Calcite	1,294	834	302	NA	NA.
Sodalite	r150	NA	315	NA	NA.
Sulfur, elemental	14,726	13,532	11,243	NA	NA.
Other	26	NA	80	NA	NA.
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural million cubic feet	55,847	NA	NA	NA	NA.
Petroleum:					
Crude thousand 42-gallon barrels	2,863	NA	NA	NA	NA.
Refinery products:					
Diesel oil 42-gallon barrels	1,777	NA	NA	NA	NA.
Gasoline, motor do.	160	NA	NA	NA	NA.
Liquefied petroleum gas do.	99,883	NA	NA	NA	NA.

rRevised. NA Not available.

[1]All data on metal exports are in terms of metal content of the materials shipped.

Table 5.—Bolivia: Leading mineral and mineral fuel exports

(Million dollars c.i.f. value)

Commodity	1976	1977	1978	1979	1980	Percent of total, 1980	Percent change, 1979-80
Minerals:							
Tin	227.9	326.6	373.7	403.4	378.1	36.5	-6
Silver	24.3	30.8	33.8	58.3	118.3	11.4	+103
Tungsten	34.8	45.1	39.5	35.1	47.4	4.6	+35
Zinc	39.1	44.7	31.4	42.7	36.7	3.5	-14
Antimony	31.4	18.0	16.6	29.6	26.4	2.6	-11
Other	21.0	25.3	20.0	22.6	34.2	3.3	+51
Total	378.5	490.5	515.0	591.7	641.1	61.9	+8
Mineral fuels:							
Natural gas	54.6	66.8	78.5	105.0	222.9	21.5	+112
Petroleum	112.6	67.4	42.3	44.0	22.6	2.2	-49
Total	167.2	134.2	120.8	149.0	245.5	23.7	+65
Other exports	65.5	83.4	86.6	118.1	149.6	14.4	+27
Grand total	611.2	708.1	722.4	858.8	1,036.2	100.0	+21

Sources: Ministry of Mines and Metallurgy and Central Bank of Bolivia.

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Antimony.—Mine output of antimony rebounded from the depressed levels of 1978-79 but fell below the record high of 1976. As detailed below in tons, the medium miner's group accounted for 75% of national output.

Company	1979	1980	Percent change
Empresa Minera Unificada S.A	7,506	7,808	+4
San Juan Limitada	2,060	2,825	+37
Churquini Enterprises Inc	458	423	-8
Bernal Hermanos	496	385	-22
Cía. Minera del Sur S.A	69	110	+59
Total	10,589	11,551	+9
Other	2,430	3,914	+61
Grand total	13,019	15,465	+19

In 1980, ENAF's antimony smelter at Vinto near Oruro approached full capacity, with an output of 4,256 tons of metallic antimony and 843 tons of antimony trioxide. The smelter, built by Skoda Export of Czechoslovakia, started up in 1976. The only active private smelter was Bernal's Palada antimony smelter, which exported 854 tons of antimony in 1980.

Cadmium.—Cadmium was produced as a byproduct of zinc mining operations. COMIBOL produced 77% of the country's total primarily at its subsidiary, the Quechisla Mining Co., followed in importance by the Matilde and Bolivia subsidiaries.

Gold.—Bolivia's gold output showed a notable response to increased world prices. A total of 20 gold cooperatives working in the Tipuani, Guanay, and Cangalli Rivers produced almost 80% of the country's total compared with the 55% share in 1977. The balance was accounted for by Compañia Minera del Sur (COMSUR) operating a dredge in the Kaka River. It was reported that a gold deposit was discovered in the Beni River, and the Cooperativa Aurífera Cachuela Experanza was formed to exploit it.

The Government was financing an evaluation of an alluvial gold deposit in a small area of the Chimate region in the Larecaja Province north of La Paz. As of December 1980, 12 pits were dug with gold values ranging from 0.0128 to 0.3377 gram per cubic meter. Reserves are being determined.

Iron Ore.—Empresa Siderúrgica Boliviana S.A. (SIDERSA) exported during 1978 and 1979 36,700 tons of iron ore, with an average iron content of 63.7%, from the Mutún Mine site to Altos Hornos Zapla in Argentina. Most of this ore was mined and stocked when Mutún was under COMIBOL control. SIDERSA endorsed a program to produce 1 million tons per year of iron pellets from the Mutún deposit. The weathered enriched ore layer at Mutún is estimated to contain reserves of 600 million tons grading 56% iron with low silica content.

On the basis of geological studies completed by Kaiser Engineers of Oakland, Calif., in September 1978, proven iron ore reserves at the Changolla deposit are estimated at 3 million tons; and another 3 million tons were indicated, with a 45% iron content. About $37 million is required for a project to produce 140,000 tons per year of ore.

Iron and Steel.—SIDERSA's iron and steel plan based on the Mutún iron ore deposit was revised downward, and the company now comtemplates construction of a plant in Santa Cruz to produce 170,000 tons per year of sponge iron using natural gas from nearby gasfields. The sponge iron plant would require about 300,000 tons per year of iron pellets produced at Mutún. The balance of 700,000 tons would be exported to Argentina each year. Output from the sponge iron plant would feed a 100,000-ton-per-year laminated products plant to be installed in Cochabamba, all for domestic consumption. SIDERSA proposes to build the $60 million rolling mill first by late 1982 to be fed with imported steel billets. Once this mill is producing, the mining and other plants will be brought online. The total project is estimated to cost $300 million.

Lead.—The Karachipampa lead-silver smelter continued under construction in Karachipampa, 7 kilometers from Potosí. The smelter will be operated as a COMIBOL-ENAF joint venture under Sociedad del Complejo Metalúrgico de Karachipampa. It was orginally scheduled for completion in March 1979, then rescheduled to start up in early 1980. The $250 million plant is now scheduled for startup in late 1982. It is projected to produce 24,200 tons of lead, 6.4 million troy ounces of silver, 1,950 tons of antimony, 780 tons of tin, 3,300 tons of zinc, and small amounts of copper and bismuth.

The plant will require a feed of 51,100 tons per year of lead concentrate, 70% from COMIBOL mines and 30% from the private sector mines. Considering that COMIBOL in 1980 produced 10,153 tons of fine lead from its mines (chiefly Tatasi, San José,

Telamayu, Matilde, and Bolivar), and the private mines (chiefly Quioma) produced 7,594 tons, the deficit in lead production for the new smelter amounts to about 6,450 tons.

In November, the Sociedad del Complejo Karachipampa signed a contract with the Fondo Nacional de Exploración, Instituto de Investigaciones Minero-Metalúrgico (IIMM) and Servicio Geológico de Bolivia (GEOBOL) to start intensive mine exploration in known lead-silver small and medium mines.

Silver.—The value of exports of silver in ore and concentrate has grown almost fivefold since 1976, reflecting elevated world prices, and has become Bolivia's third most valuable mineral export after tin and natural gas. Bolivia is the fourth most important silver producer in Latin America after Mexico, Peru, and Chile.

Silver output in 1980 came mostly from COMIBOL companies—84%, medium mines—11%, and small mines—5%. Empresa Minera Quenchisla, COMIBOL's second largest mining company, was its largest silver producer at almost 3.1 million troy ounces, followed by Empresa Minera San José. During 1980, a rich silver vein was discovered at San José. The Ventillas zinc-silver mill completed in 1978 at the Quechisla Co. is programmed to produce 1.7 million troy ounces of silver per year.

Tin.—Although Bolivia is the major tin producer in Latin America, it fell from second to fourth rank as a world producer behind Malaysia, Thailand, and Indonesia. In 1980, Bolivia's main producers in tin content were COMIBOL (18,621 tons), medium mines (5,880 tons), and small mines (2,771 tons). COMIBOL accounted for 68% of total output primarily from the subsidiary companies in the tin belt of Huanuni (its most profitable), Catavi, Quechisla, Unificada, and Colquiri. The mining cooperatives associated with COMIBOL produced 1,467 tons or 8% of the State company's total.

Practically all of the 23 medium miners in the NAMM produced tin. Table 6 provides tin output data for the leading companies.

COMIBOL's production of tin concentrate was of three grades—about 70% so-called high-grade (42% tin), 10% was medium-grade (32.6% tin), and 20% was low-grade (below 14% tin). COMIBOL's average mill recovery was 55%, the balance of the tin mined going as waste in mill tailings and slimes. Most of the low-grade tin concentrate is used as direct feed to the volatilization plant.

COMIBOL's cost of producing and marketing of tin continued to increase, as summarized in table 7. Total costs increased 25% in both 1978 and 1979. A detailed study of production costs incurred by COMIBOL's subsidiaries shows that 75% of COMIBOL's tin production is above the average London Metal Exchange (LME) price for April 1979, indicating that most of COMIBOL's companies were not operating at a profitable level. In 1979, railway freight costs from production centers to Arica and Antofagasta in Chile increased over 18%. Consequently, some export traffic was directed to Peruvian seaports. The expansion of the smelting industry has reduced the volume of minerals shipped to the Pacific coast by railway.

Table 6.—Bolivia: Major tin production by medium miners

(Metric tons of fine content)

Company	1978	1979	1980	Percent change, 1978-80
Cia. Minera del Sur S.A	1,121	1,256	1,268	+13
Estalsa Boliviana S.A.[1]	1,464	973	822	-44
International Mining Co.[1]	707	638	650	-8
Avicaya Ltda.[1]	582	575	592	+2
Cia. Minera Orlandini Ltda	382	538	539	+41
Yana Mallcu Ltda	558	497	410	-27
Atoroma Ltda	265	290	407	+54
Barrosquira Ltda	259	241	247	-5
Cerro Grande Ltda	227	195	220	-3
Berenguela Ltda	178	158	214	+20
Total	5,743	5,361	5,369	-7
Other medium miners	794	569	530	-33
Grand total	6,537	5,930	5,899	-10

[1]Member companies of the ESTALSA Group.

Source: Annual Reports of the National Association of Medium Miners founded in May 1939.

Table 7.—COMIBOL's tin mining and marketing costs

(Dollars per pound)

Year	Mining costs	Export taxes	Royalties	Handling transport, insurance, smelting	Total cost on market[1]	Average London Metal Exchange price
1971	1.10	0.14	--	0.31	1.54	1.59
1972	1.03	.18	0.08	.35	1.64	1.71
1973	1.05	.37	.23	.48	2.13	2.18
1974	1.60	.24	.81	.59	3.24	3.71
1975	1.59	.21	.55	.67	3.03	3.11
1976	2.02	.28	.72	.78	3.80	3.40
1977	1.98	.36	1.14	.90	4.38	4.86
1978	2.49	.38	1.45	1.15	5.47	5.84
1979	3.32	.44	1.81	1.27	6.84	7.15

[1]Data may not add to totals shown because of independent rounding.

Source: COMIBOL.

COMIBOL's tin volatilization (fuming) plant continued under construction at La Palca, 17 kilometers southwest of Potosí. The $65 million plant was designed and supervised by the U.S.S.R. under a $27.5 million credit granted to the Government in 1970. The plant will have an input capacity of 400 tons per day of 3% to 6% tin concentrate and an annual output of 3,500 tons of 50% tin powder. Feed to the plant will be from Unificada-Pailaviri preconcentration plant and the Catavi-Canutillos Mine. The plant is estimated to require 600,000 barrels per year of fuel oil. YPFB produced and sold 935,000 barrels of fuel oil in 1979 for internal market demand. Conversion to natural gas use was under study. In mid-1979, COMIBOL signed a contract with the Soviet firm Machino-Export for a second volatilization plant to be built at Machacamarca.

During 1980, ENAF fired its second tin smelter for treating low-grade (10% to 35% tin) concentrate at Vinto, 10 kilometers from Oruro. The low-grade smelter with a capacity of 10,000 tons per year was designed and built by Klöckner Humblod Deuz A.G., Novosikusk, Machino-Export, and P. Bergsoe and Sons under a $49 million contract. At yearend, the new plant was undergoing trials with full operation expected in July 1981.

ENAF achieved a record high output of refined tin from its high-grade (42% tin) smelter also at Vinto. This 20,000-ton-per-year plant was first fired in 1970, with an initial capacity of 7,500 tons per year. The following tabulation shows the rising trend in refined tin output in metric tons.

Year	Refined tin	Percent of mine output
1975	7,533	29
1976	9,185	30
1977	12,788	39
1978	16,180	52
1979	15,696	57
1980	17,648	65
1981[e]	21,220	75

[e]Estimated.

Tungsten.—Bolivia is the leading producer of tungsten in Latin America. Output by COMIBOL in 1980 increased 16%, replacing the medium miners as the main producer. Output by the medium miner's group increased 4% through only two companies—International Mining Co. and San José de Berqué.

Exports of tungsten increased sharply by 30% and replaced zinc as Bolivia's third most valuable nonfuels mineral export after tin and silver.

Zinc.—In July 1979, Klöckner Industrie Anlagen presented to ENAF the feasibility study of the 68,300-ton-per-year zinc refinery plant to be located in the Department of Potosí. The $220 million plant will also produce 72,600 tons per year of sulfuric acid, of which 63,600 tons would be available for sale. At yearend, the feasibility study was under final review by the Canadian firm Surveyer, Nenninger and Chenevert Inc.

NONMETALS

Barite.—The Baroid Div. of NL Industries Inc., in a joint venture with Mosamar of Bolivia, initiated production from a new

grinding plant located at Oruro. A local barite source provides feed to the mill.

Cement.—Bolivia was engaged in a program to expand its cement capacity to meet requirements of its development projects, to reduce imports, and to set the stage for eventual exports to Brazil. Construction continued on the new $88 million plant in Yacuces, 120 kilometers west of Corumbá on the Brazilian border. The 335,000-ton-per-year plant being built by the Comite de Obras Publicas de Santa Cruz under 55% financing by the Inter-American Development Bank is scheduled for completion in 1981. Lafarge Consultoria et Estudos has the consulting engineering contract.

At the end of 1978, Bolivia's three operating cement companies had a combined capacity of 810,000 tons per year.

MINERAL FUELS

Natural Gas.—Bolivia continued the historical reversal begun in 1978 of earning more from exports of natural gas than from petroleum. In 1980, the value of gas exports to Argentina increased to $223 million compared with the $29 million of gas exports in 1974, a sevenfold growth.

In early 1980, the Governments of Bolivia and Argentina renegotiated the price of natural gas from $1.54 per thousand cubic feet to $2.50 per thousand cubic feet by June 1980, through monthly adjustments. In September, further monthly price increases were agreed upon so that by December 1980 the rate was $2.80 per thousand cubic feet, and by March 1981 the price would rise to $3.30 per thousand cubic feet. It was also agreed that the exported volume would change from 195 to 230 million cubic feet per day, effective April 1981.

Table 8 provides data on the distribution of natural gas production. YPFB gasfields of Río Grande and Colpa were the major producing gasfields followed by the Tita Field of Occidental Boliviana Inc. and the La Vertiente Field of Tesoro Bolivia Petroleum Co. The Tita Field continued to produce natural gas slightly above the average contract rate of 50 million cubic feet per day.

Plans remained indefinite regarding installation of distribution lines to households in Cochabamba, Sucre, Oruro, Potosí, and Santa Cruz.

After many years of negotiations, a provisional agreement was expected in early 1981 regarding construction of a 1,940-kilometer natural gas pipeline between Santa Cruz, Bolivia, and São Paulo, Brazil. The project, estimated to cost $1.7 billion, was expected to be initiated during the first half of 1982 and be ready for use by yearend 1985. Brazil will probably import about 400 million cubic feet per day. This project offers Bolivia the best opportunity of increasing export earnings in the near future.

Table 8.—Bolivia: Distribution of natural gas production

(Million cubic feet)

	1976	1977	1978	1979	1980	Percent of total, 1980	Percent change, 1979-80
Injected	71,442	r70,536	72,391	79,118	78,321	46	-1
Flared	r20,761	13,365	18,142	10,600	7,200	4	-32
Local fuel[1]	2,463	2,766	2,938	3,949	4,665	3	+18
For sale[2]	59,302	62,408	61,297	66,294	78,644	47	+19
Total	153,968	149,075	154,768	159,961	168,830	100	+6

rRevised.

[1]Used by YPFB's field plants and refineries.

[2]Includes sales to Argentina and domestic users. In 1980 this amounted to 72,029 million cubic feet for Argentina, 18% higher than in 1979.

Source: YPFB Annual Reports.

Petroleum.—The downtrend in the production of crude oil and condensate continued since the peak year of 1973. In 1980, crude oil output declined 26%, representing 37% of total hydrocarbons produced, while condensate accounted for 63% of the total. The total daily average of crude plus condensate was 23,850 barrels in 1980. Output was projected to increase to 38,400 barrels per day in 1985. The Monteagudo Field was the main crude oil producer, followed in importance by La Peña, Caranda, and Camiri. By far, the Río Grande Field was the main producer of condensate, followed by Tita, La Vertiente, and Colpa Fields.

Sharply reduced domestic output (50% down from 1973 levels) and increased domestic consumption have forced Bolivia to discontinue exports of crude oil. In 1973, these exports had been as high as 11.8 million barrels. According to revised figures, Bolivia did export 165,000 barrels of crude oil in 1979, while in 1980 only gasoline was exported to Argentina.

In 1980, no new operations contracts were signed with foreign oil companies following issuance of the Government's new hydrocarbons policy of June 1977. On July 30, 1980, the Government approved two contracts between YPFB and Occidental Boliviana Inc. concerning the transport of liquid petroleum products and the sale of natural gas. The major new element centered on the opening of substantial production by Occidental at the Porvenír Field discovered in 1978 in the Department of Chuquisaca near Luis Calvo. Occidental began drilling additional gas-condensate wells at Porvenír. Construction began on a treatment plant for processing 100 million cubic feet per day of natural gas in order to extract an estimated 8,200 barrels per day of condensate. The gas will be reinjected for future marketing.

In mid-1980, the Government appointed a committee to study and make recommendations within 6 months relative to a national energy policy.

In May, the International Development Association, the World Bank's affiliate for concessionary lending, approved a $16 million credit for a gas and oil engineering project in Bolivia. The Inter-American Development Bank made a parallel loan of $16 million for the same project. The $41.8 million project is an important precondition for achieving a significant increase in gas exports. The project seeks to establish by 1982 whether there are sufficient reserves of natural gas in the Departments of Santa Cruz, Chuquisaca, and Tarija to enable YPFB to cover future requirements of Bolivia's growing domestic market and gas exports to Brazil, as well as the existing contracts for gas exports to Argentina. The project includes the initial phase of a secondary recovery (water injection) program for the Monteagudo oilfield. Also included is an engineering study of the proposed Bolivia-Brazil gas pipeline and of the Bolivian gas market.

Retail prices of petroleum products prevalent during 1980 were those established in November 1979, after a 4-year period without any price changes. Motor gasoline (92 octane) was priced at $0.24 per liter, and diesel and fuel oil were priced at $0.16 per liter. In 1980, Bolivia was generally self-sufficient in petroleum products. During the year, however, shortages were experienced in diesel and fuel oil and lubricants. In December, the Minister of Energy and Hydrocarbons reportedly asserted that the Government would terminate price subsidies on all petroleum products. YPFB had a monopoly on the refining and sale of hydrocarbons in the country. Surprisingly, in 1980 domestic consumption fell almost 11% compared with that of 1979.

The Minister also stated that the Soviet Union offered to assist Bolivia in the exploration for and production of hydrocarbons.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Bolivian pesos ($b) to U.S. dollars at the rate of $b24.5=US$1.00.

Table 9.—Bolivia: Production of crude oil and condensate by YPFB and contractor, by field[1]

(Thousand 42-gallon barrels)

Field	1975	1976	1977	1978	1979	1980	Percent change, 1979-80
Río Grande	4,578	5,412	5,080	4,660	4,233	3,758	-11
Monteagudo	2,471	1,867	1,486	1,267	1,290	1,077	-17
Tita	--	--	--	919	1,042	730	-30
La Peña	2,069	2,824	2,208	1,829	1,060	634	-40
Caranda	1,527	1,345	1,165	853	641	454	-29
Colpa	1,363	1,029	841	630	553	562	+2
Camiri	566	559	512	465	441	373	-15
La Vertiente	--	--	--	17	80	345	+331
Palmar	--	--	--	261	145	289	+100
Caigua	1,568	1,319	641	355	176	91	-48
Cambeiti	--	16	178	202	154	96	-38
Tatarenda	235	241	207	143	137	96	-30
Bermejo-Toro	83	58	88	82	105	85	-19
Guairuy	78	53	35	32	30	43	+43
San Alberto	58	52	44	35	29	25	-14
Camatindi	28	31	36	33	26	25	-4
Other	[2]108	[3]50	[4]155	[5]61	[r 6]32	[7]21	-34
Total	14,732	14,856	12,676	11,844	10,174	8,704	-14

[r]Revised.

[1]In 1978, Occidental produced from the new Tita Field and Tesoro from the new La Vertiente Field; in 1979 Occidental's Porvenir Field entered production.

[2]Includes output from Los Monos, Buena Vista, and Tigre.

[3]Includes output from Los Monos, Buena Vista, Tigre, and Montecristo.

[4]Includes output from Los Monos, Buena Vista, Montecristo, and Espejos.

[5]Includes output from Buena Vista, Espejos, and a small amount from Tigre. Los Monos was shut down.

[6]Includes output from Vuelta Grande, Buena Vista, Espino, and Porvenir.

[7]Includes output from Buena Vista, Espino, Los Monos, Vuelta Grande, and Montecristo.

The Mineral Industry of Botswana

By George A. Morgan[1]

The mineral industry of Botswana continued to be the fastest growing sector of the economy in 1980, providing a major portion of foreign exchange earnings and a substantial share of Government revenue. Income from diamond production alone accounted for one-third of Government revenue. Average real growth for the country's economy was estimated at 10%. Due in large part to the performance of the mining industry, foreign exchange reserves were $380 million[2] at midyear 1980, equivalent to the value of about 6 months' imports. The debt-service ratio was 1%, while inflation was 16%. The 1979-85 national development plan (NDP) was to emphasize employment creation and rural development because 80% of the country's population was in rural areas. Mine worker recruitment by the Republic of South Africa declined from 40,000 in 1976 to about 20,000 in 1979, increasing the unemployment problem. The Government had a greater responsibility for assessment and supervision of projects despite a serious shortage of skilled personnel, with expenditures of $1,310 million planned for the period of the NDP. A budget deficit of $81 million was expected in 1981 because of rapid growth in Government spending compared with 3 previous years of surplus. Industrial expansion projects, whether Government funded or privately financed, had to contend with the high cost of utilities and housing, as well as a high minimum wage and high taxes.[3]

PRODUCTION AND TRADE

The index of mining production increased by 9.5% in 1980. Value of production of the leading mineral products in 1980 was as follows: Diamonds, $302 million compared with $208 million in 1979; copper and nickel, $112 million compared with $94 million in 1979; and coal, $5.5 million compared with $3.4 million in 1979. Diamond production in Botswana was expected to increase significantly upon opening of the new Jwaneng Mine, as was output of copper-cobalt-nickel matte from the Selebi and Phikwe Mines. Interest was being shown in expanding output of coal, both for domestic consumption and for export. Although magnetic and gravity surveys conducted in 1979 indicated substantial sediment thickness in the western part of Botswana, no permits were held for exploration of petroleum.

The Government began to take control of the railroads formerly operated by the National Railways of Zimbabwe. An agreement was also signed with the Federal Republic of Germany whereby $19 million would be made available as funding for locomotives and railroad maintenance facilities in Francistown. The value of exports in 1980 was estimated at $527 million compared with imports estimated at $709 million. The trade imbalance was expected to continue in 1981. Principal trading partners in order of importance were the Republic of South Africa, the United Kingdom, Western Europe, and Zimbabwe.

Table 1.—Botswana: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
Coal, not further described	[r]224,099	294,039	314,486	355,115	371,395
Cobalt, Co content of nickel-copper matte[2]	[r]198	165	261	294	226
Copper:					
Mine output, metal content[3]	17,887	16,160	17,235	17,419	[e]18,600
Cu content of nickel-copper matte[2]	[r]12,473	11,788	14,615	14,563	15,553
Diamond:					
Gem[e] thousand carats	[r]354	404	[r]420	[r]659	765
Industrial[e] do.	[r]2,007	2,287	[r]2,379	[r]3,735	4,336
Total do.	[r]2,361	2,691	2,799	4,394	5,101
Gem stones, semiprecious, rough, not further described kilograms	[r]42,000	50,000	10,000	5,000	20,000
Nickel:					
Mine output, metal content[3]	22,254	19,859	21,859	22,109	[e]21,100
Ni content of nickel-copper matte[2]	[r]12,581	12,094	16,049	16,173	15,442
Nickel-copper matte, gross weight	32,506	30,772	39,517	39,823	40,099
Sand and gravel cubic meters	151,063	135,840	133,553	229,856	201,925
Stone, crushed, not further described do.	100,684	127,983	141,415	228,526	222,033
Talc	[r]144	288	313	104	78

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 29, 1981.

[2]Figures approximate recoverable mine output and have been used as such in world production tables appearing in volume 1 of Minerals Yearbook.

[3]Analytic content of ore milled.

COMMODITY REVIEW

METALS

Copper-Nickel-Cobalt.—Botswana RST Ltd. (BRST), owner of the Selebi and Phikwe Mines, had a 14% increase in both mine output and mill throughput in 1980. Production of concentrates was up by nearly 78,000 tons, while matte production increased slightly to 40,099 tons. Ore production from underground operations at the Phikwe Mine was 1.57 million tons grading 1.16% nickel and 0.8% copper. The decline in grade from that of the previous year was compensated by slightly higher production. The Selebi Mine's underground operation was in full production by midyear, while the open pit mine at Phikwe ceased production in August. Total output from the open pit mine was 0.34 million tons grading 0.75% nickel and 0.66% copper. Underground ore from the Selebi Mine graded 0.46% nickel and 0.94% copper. The sinking of the third shaft at the Selebi Mine continued but encountered water at the 750-meter depth. Production from the shaft was to commence in 1982 following commissioning in late 1981. Overall, 2.5 million tons of ore were milled, grading 0.93% nickel and 0.82% copper. Matte output and average metal content of matte for the period 1977-80 are listed in the following tabulation.

	1977	1978	1979	1980
Matte production metric tons	30,772	39,517	39,823	40,099
Matte content:[1]				
Nickel percent, average	39.3	40.6	29.9	38.5
Copper do.	38.3	36.9	28.5	38.8
Cobalt do.	.54	.66	.55	.56

[1]Average content for sulfur and impurities was 22% for each of the years shown.

Total sales reported by BRST for the year ending December 31, 1980, were $144 million compared with $69 million in 1979. Mining assets and other capitalized expenditures amounted to $362 million in 1980 compared with $326 million in 1979. However, total liabilities amounted to $464 million at yearend 1980. The adjusted accumulated deficit was reported at $192 million, up 11% from that of the previous year. Based on terms of an amendment to the mining lease that provided a royalty payment of 3% on the gross value of recoverable metal, BCL Ltd., which operated the mines and was 85% owned by BRST, owed the Government $6.2 million in 1980. However, a deed of deferral, effective December 31, 1979, provided for deferral of loan principal payments and royalty payments during the

period to December 31, 1983, if BCL had a negative cash flow position. Loan principal repayments and royalty payments of an estimated $17.5 million, falling due in 1981, were also expected to be deferred. As of December 31, 1980, BCL had an estimated loss for tax purposes of about $221 million available to be carried forward against future taxable income. Capital cost of $275 million may also be amortized against future income subject to the limitation of a maximum relief of 75% of taxable income in any year.[4]

NONMETALS

Diamond.—At the Orapa Mine of De Beers Botswana Mining Co. (Proprietary) Ltd., diamond output in 1980 amounted to 4,699,608 carats from a throughput of 7,329,600 tons of ore, yielding a recovery rate of 64.12 carats per 100 tons of ore. The company's Letlhakane Mine yielded 401,423 carats from a throughput of 2,112,900 tons of ore for a recovery rate of 19 carats per 100 tons of ore. The decline in diamond yield at the Letlhakane Mine from 23.22 carats per 100 tons of ore in 1979 was due in part to lower diamond content of kimberlite treated and to treatment of residual ferruginous gravels earlier in the year. Production startup at the main treatment plant at the Jwaneng Mine was planned for early 1982. Geological investigation and stripping of sand overburden continued in 1980, and blasting of rock overburden began at midyear with the commissioning of rotary drills and electric shovels.

Total waste removal amounted to 0.580 million cubic meters compared with a target of 1.5 million cubic meters due to unspecified difficulties. However, a revised production schedule was expected to be met with the aid of additional equipment in 1981. The bulk sampling plant and ancillary workshops, roads, and services were substantially completed, as well as the mine township. A rail siding was completed at Lobatse, and a tarred road to Kanye and a tarred airstrip at the mine were put into operation.[5] When the Jwaneng Mine is in full production, total output for Botswana may double from present levels to about 10 million carats per year. Employment at the Orapa and Letlhakane Mines was about 2,400 people in 1980, and the Jwaneng Mine was expected to employ about 1,300 people.

Diamond production in Botswana was shipped to the Botswana Diamond Valuing Co. in Gaborone for grading. Graded diamonds were then purchased by the Diamond Corp. Botswana (Pty.) Ltd., part of the De Beers Central Selling Organization, for eventual marketing worldwide. It was reported at yearend 1980 that the diamond agreement between the Government and the De Beers Central Selling Organization was being renegotiated.

Exploration continued at a small kimberlite site near the Jwaneng occurrence, and two additional sites near the Orapa Mine were being evaluated for possible development.

MINERAL FUELS

Coal.—Coal production was estimated at 380,000 tons for 1980, up about 40,000 tons from that of the previous year but short of the expected goal of 1 million tons. No coal was exported; all production was used for electric power generation or for consumption at the Selebi-Phikwe furnace as a replacement for diesel fuel.[6] The Ministry of Mineral Resources and Water Affairs reported that it intended to foster the production of coal for export. Several firms were interested in coal exploitation near Morupule, and Shell Coal Botswana submitted a feasibility study for the opening of a coal mine in its prospecting area between Morupule and Serowe.

The Government also decided to build a coal-fired power station at Morupule. Feasibility and preliminary engineering studies neared completion, and funding discussions had been held with the World Bank.

Petroleum.—Construction of oil storage tanks located in Gaborone and Francistown was completed. When filled, the tanks were to provide a 3-month supply of oil to cover the country's petroleum needs in case of a supply interruption. The cost for their construction was $4.2 million, and the cost to fill the tanks was put at $1.2 million.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Botswana pula (P) to U.S. dollars at the rate of P1 = US$1.27 for 1979 and P1 = US$1.35 for 1980.

[3]The Financial Times (London). Botswana. No. 28,152, Apr. 6, 1980, pp. 19-23.

[4]Botswana RST Ltd. Annual Report 1980. 27 pp.

[5]De Beers Consolidated Mines Ltd. Annual Report to December 31, 1980, 93rd Annual Report. 1980, 29 pp.

[6]Mining Journal (London). Improvement at Selebi-Phikwe. V. 295, No. 7579, Nov. 21, 1980, p. 415.

The Mineral Industry of Brazil

By Orlando Martino[1]

In real terms, the Brazilian economy in 1980 grew by 8%, surprising most economic observers who had expected a growth closer to the 6.4% rate of 1979. Brazil's gross domestic product (GDP) in current prices expanded to an estimated $237 billion.[2] At yearend the rate of inflation was 110% compared with 77% in December 1979.

In 1980, Brazil made further progress in expanding its mineral industries and was a leading or important supplier of mineral commodities in the Latin American region and in world markets. Particular gains were achieved in exploiting Brazil's relatively recently evaluated mineral potential in gold, bauxite, phosphate rock, and coal.

In value terms, Brazil's diversified mineral output, not including petroleum, is among the largest in Latin America, but is comparatively a small part of the national economy where agriculture and manufacturing dominate. The mineral sector in 1980 contributed about 1.8% of the GDP. The importance of the mineral sector was more apparent in Brazil's international trade where the share of mineral exports was over 10%. Exports of iron ore alone in 1980 was 8% of the total as in 1979.

Besides iron ore, Brazil continued as an important producer and exporter of manganese, pyrochlore concentrate, beryl, ferroalloys (particularly ferrocolumbium), electronic-grade quartz crystal, and gem stones. For the first time in 1980, Brazil became a significant exporter of bauxite from the Trombetas operation in the Amazon Basin. Record production levels were achieved in phosphate rock, coal, crude oil, and natural gas. Gold output escalated because of the Serra Pelada discovery.

The dominant mineral company in Brazil and the world's largest producer and exporter of iron ore was Companhia Vale do Rio Doce (CVRD). CVRD was engaged in the important Carajás iron ore project as well as the production of phosphate rock and bauxite through associated companies. As a mixed capital company, CVRD was 80% owned by the Government and 20% by private Brazilian shareholders.

The mineral fuels sector was dominated by the state oil monopoly, Petróleo Brasileiro S.A. (PETROBRAS), owned 75% by the Government and 25% by local private interests. As a result of intensified exploration and development, PETROBRAS had some success in achieving record levels in the production of crude oil and natural gas as well as their corresponding proven reserves.

Companhia de Pesquisa de Recursos Minerais (CPRM), an autonomous state entity, continued its extensive program of geological exploration.

Government Policies and Programs.—A major event in the mineral sector was the decision by the Government in November 1980 to approve a 10-year plan to develop the large and varied resources of the Carajás Mineral Province, Pará State, in the south Amazon Basin. In addition to massive high-grade iron ore reserves, Carajás includes substantial reserves of manganese, bauxite, copper, nickel, tin, and gold. The global project covering mineral and agricultural resources would absorb $61 billion, of which $26 billion would be required for mineral development. Mineral processing facilities (smelters) are contemplated in the program. A new railroad and shipping port near São Luis are included for transport of mineral output to domestic and world markets.

The Government assigned development of the Carajás iron ore deposit to CVRD.

Indications were that exploitation of the remaining mineral resources would be assigned to the private Brazilian mineral sector and foreign interests.

For 1981, the Government announced a goal of limiting petroleum imports to 750,000 barrels per day. Brazil consumed an average of 1.1 million barrels of oil per day, of which 929,000 barrels per day were imported in 1980.

The Brazilian Government has been reluctant to allow foreign participation in the national alcohol fuel program. It appeared likely that foreign investment in this area would be limited to producing alcohol fuel for export.

The Government was considering changes in rules on the registration of foreign capital, particularly reinvestments, which would have implications for the foreign remittance of profits.

Foreign direct investment and reinvestment in the mining sector was $372 million in 1979 compared with a total of $155 million in 1975. Total foreign investment in Brazil in 1979 in minerals and energy related sectors is detailed below in million U.S. dollars:

Sector	Total investment and reinvestment	Percent share
Mineral extraction	372.4	2.3
Iron and steel	345.8	2.2
Metallurgy	969.5	6.1
Cement	119.4	0.7
Fertilizers	170.3	1.1
Basic chemicals	1,728.0	10.8
Petroleum derivatives	337.7	2.1
Total	4,043.1	25.3
Total foreign investment in all sectors of economy	15,962.9	100.0

Within the mining and related sectors, the foreign investment from the United States totaled $1.04 billion and accounted for about 28% of the total. Next in importance were the Federal Republic of Germany, 14.8%; Switzerland, 9.1%; United Kingdom, 8.4%; and Japan, 8.1%.

PRODUCTION

Preliminary data indicate that in real terms the value of output of the extractive industries grew by almost 13% in 1980. The latest available official data reported by the Departamento Nacional da Producão Mineral (the National Department of Mineral Production, DNPM)[3] of the Ministry of Mines and Energy shows that in real terms the value of mineral output grew by 11.2% in 1979 compared with the 4.6% growth in 1978.

Total value of mineral output in 1979 was comprised of crude oil, 28%; iron ore, 20%; crushed rock, 10%; coal, 4.6%; phosphate rock, 3%; natural gas, 2.7%; pyrochlore, 2.5%; and tin, 2.3%. Overall in 1979, mineral fuels contributed 35.6% of total mineral output, followed by metallic minerals, 31.6%; nonmetallic minerals, 31.4%; and diamond and gems, 1.4%.

Table 1 provides reported and revised production data for 1976-80. Where reported data is not available for certain minerals in 1980, estimates are given.

Gold production escalated because of the Serra Pelada discovery in the Carajás region. Output of iron ore continued its upward trend as new capacity was utilized. The rate of growth of crude steel output slowed somewhat to 10.3%, while output of ferroalloys continued its strong expansion by increasing 14%. In 1980, Brazil became Latin America's third most important producer of bauxite after Jamaica and Suriname and was the leading aluminum producer.

Among nonmetallics, mine output of phosphate rock increased almost 60% because of the startup of several new projects in 1979. Sulfur output from oil shale and refinery operations increased but remained far below domestic demand.

Brazil's drive to reduce dependency on petroleum imports was manifested in the 14% increase in production of marketable coal. Output of metallurgical and steam coal has risen sharply since 1973 when the world energy crisis began. Output of crude oil and natural gas reached record levels.

Table 1.—Brazil: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	826,715	1,119,510	1,160,112	2,387,741	[3]4,152,000
Alumina	[r]306,183	[r]340,800	352,100	449,100	[3]506,000
Metal:					
Primary	139,175	167,100	186,365	238,009	[3]260,600
Secondary	25,700	33,500	31,817	37,905	50,000
Antimony, mine output, metal content	[r]27	[r]262	[r]196	67	65
Beryllium: Beryl concentrate, gross weight	368	[r]496	739	453	400
Chromium:					
Crude ore	886,514	683,147	957,798	891,543	450,000
Concentrate	[r]132,455	[r]250,281	203,107	229,836	250,000
Marketable product[4]	186,106	[r]309,995	269,870	340,385	360,000
Columbium-tantalum ores and concentrates, gross weight:					
Columbite and tantalite	198	[r]137	203	374	250
Djalmaite concentrate	24	19	19	10	20
Pyrochlore concentrate	19,003	15,613	17,900	28,909	30,000
Copper:					
Mine output, metal content	54	25	59	5,262	[3]1,400
Metal, secondary	[r]39,270	[r]45,947	45,000	50,000	50,000
Gold:					
Mine output troy ounces	119,536	121,048	128,860	107,158	150,000
Garimpos (prospectors)[5] do	119,984	158,472	172,038	212,100	1,150,000
Total do	239,520	279,520	300,898	319,258	1,300,000
Iron and steel:					
Ore and concentrate (marketable product):[4]					
Gross weight thousand tons	94,087	82,001	84,985	104,083	106,000
Iron content do	61,157	53,301	55,240	67,654	68,900
Metal:					
Pig iron[6] do	8,432	9,739	10,331	11,918	12,960
Ferroalloys, electric-furnace:					
Ferrochromium	[r]65,610	65,969	62,170	84,514	[3]93,443
Ferrocolumbium	10,010	6,809	10,251	13,913	[3]17,530
Ferromanganese	[r]98,978	128,922	117,843	133,563	[3]140,496
Ferronickel	9,971	10,860	10,976	11,355	[3]11,280
Ferrosilicon	45,252	[r]60,290	72,842	75,712	[3]109,140
Ferrosilicochrome	[r]3,575	4,121	4,698	7,239	[3]8,086
Ferrosilicomanganese	63,843	75,108	106,249	127,503	[3]134,243
Silicon metal	5,349	4,885	5,831	5,654	[3]12,379
Other:					
Ferroboron	15	33	11	26	[3]27
Ferromolybdenum	863	1,177	1,690	1,469	[3]802
Ferrophosphorus	--	--	--	148	[3]354
Ferrotitanium	419	654	436	795	[3]698
Ferrotungsten	285	141	336	396	[3]217
Ferrovanadium	202	366	456	851	[3]807
Ferrocalcium silicon	1,350	4,500	5,790	6,639	[3]8,025
Ferrosilicon magnesium	6,181	7,443	9,968	14,432	[3]13,734
Ferrosilicon zirconium	--	--	--	--	[3]488
Total	[r]311,903	[r]371,278	409,547	484,209	[3]551,749
Steel, crude, excluding castings thousand tons	9,169	11,164	12,107	[3]13,893	[3]15,318
Semimanufactures, flat and nonflat do	7,018	8,412	10,126	11,693	[3]12,985
Lead:					
Mine output, metal content	22,615	24,039	31,203	27,927	[3]25,100
Metal:					
Primary	43,672	48,303	47,236	55,084	[3]44,600
Secondary	[r]25,534	[r]29,001	33,220	42,200	[3]40,400
Manganese ore and concentrate (marketable),[4] gross weight	1,696,200	1,515,673	1,917,120	2,259,331	2,200,000
Nickel:					
Mine output, metal content	5,273	4,241	3,600	2,964	[3]2,500
Ferronickel, Ni content	2,149	2,530	2,228	2,463	[3]2,500
Rare-earth metals: Monazite concentrate, gross weight	1,610	2,441	2,841	1,900	2,000
Silver[7] thousand troy ounces	[r]454	372	506	1,065	1,125
Tin:					
Mine output, metal content	5,388	[r]6,287	6,980	7,217	[3]6,800
Metal, smelter, primary	[r]6,423	[r]7,421	9,309	10,133	[3]8,800

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Titanium concentrates, gross weight:					
Ilmenite	14,615	13,268	20,077	22,657	20,000
Rutile	51	128	365	439	400
Tungsten, mine output, metal content	r1,002	1,212	1,165	1,177	1,200
Zinc:					
Concentrate and salable ore	183,209	205,671	209,719	344,389	406,800
Mine output, metal content	r51,299	r57,588	58,721	89,886	105,000
Metal, smelter:					
Primary	43,154	r47,032	56,097	63,494	378,300
Secondary	r9,565	r8,532	12,200	12,700	13,000
Zirconium: Zircon concentrate, gross weight[8]	3,058	4,649	4,301	3,605	4,000
NONMETALS					
Asbestos:					
Crude ore	1,442,223	1,512,997	2,080,371	2,422,420	2,362,000
Fiber	92,703	92,773	122,815	138,457	135,000
Barite:					
Crude	51,238	39,575	238,257	489,997	480,000
Beneficiated	25,887	39,353	87,145	73,014	70,000
Marketable product[4]	32,070	49,528	107,492	108,042	105,000
Calcite	r13,514	r6,281	18,467	16,922	NA
Cement, hydraulic thousand tons	19,147	21,123	23,187	24,874	26,500
Clays:					
Bentonite	143,218	108,395	167,614	212,503	250,000
Kaolin:					
Crude	710,254	939,666	1,595,482	1,343,005	1,720,000
Beneficiated	209,704	259,836	294,459	349,446	448,000
Marketable product[4]	315,056	372,488	370,062	943,589	1,050,000
Other:					
Crude thousand tons	3,229	3,514	4,457	3,900	NA
Beneficiated do	1,458	1,575	1,029	1,620	NA
Diamond:					
Gem[e] thousand carats	r214	r274	r291	r305	305
Industrial[e] do	r47	r46	r49	r55	55
Total[e 9] do	r261	r320	r340	r360	360
Diatomite:					
Crude	5,036	11,204	32,940	136,669	140,000
Beneficiated	4,179	4,966	10,709	6,650	7,000
Marketable product[4]	4,533	9,559	12,030	16,547	17,000
Feldspar and related materials:					
Feldspar, marketable product[4]	84,134	96,187	103,597	363,382	367,000
Leucite, marketable product[4]	r5,862	r8,232	8,075	511	5,000
Sodalite, crude (marketable product)	643	982	687	2,610	3,000
Total	r90,639	r105,401	112,359	366,503	375,000
Fluorspar:					
Crude	49,396	115,960	126,232	163,179	163,200
Marketable products:					
Direct-shipping crude ore (sales)	55	13,162	465	106	100
Concentrates:					
Acid-grade	31,105	r27,280	31,174	38,000	38,000
Ceramic-grade		r476			
Metallurgical-grade		r27,663	30,161	37,000	37,000
Total marketable products	31,160	r68,581	61,800	75,106	75,100
Graphite:					
Crude	31,395	53,603	47,845	135,977	145,000
Marketable products:					
Direct shipping crude ore			859	85,130	91,400
Concentrate	6,018	9,187	10,357	10,867	11,600
Total	6,018	9,187	11,216	95,997	103,000
Gypsum and anhydrite, crude	545,463	543,046	474,732	464,730	560,000
Kyanite:					
Crude	256	110	6,908	8,193	8,200
Beneficated	66	17	1,356	1,299	1,300
Marketable products[4]	75	17	1,773	1,750	1,750
Lime, hydrated, and quicklime[e] thousand tons	4,300	4,500	4,500	4,500	4,500
Lithium mineral concentrates:					
Amblygonite	185	489	431	187	300
Lepidolite	1,332	579	50	58	100
Petalite	968	1,028	1,996	1,501	1,400
Spodumene	413	112	885	--	350
Total	2,898	2,208	3,362	1,746	2,150

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Magnesite:					
Crude[10]	414,612	481,154	409,936	590,240	745,000
Beneficiated	195,877	205,719	217,270	265,671	336,000
Mica, all grades[11]	2,799	1,955	4,551	4,073	4,000
Nitrogen: N content of ammonia	144,200	145,500	202,900	265,500	[3]351,600
Phosphate rock, including apatite:					
Crude:					
Mine product thousand tons	3,256	3,425	5,967	12,478	[3]20,400
Of which sold directly do	15	26	27	39	40
Concentrate:					
Gross weight do	490	650	1,023	1,589	2,600
P_2O_5 content do	[r]176	[r]195	367	589	960
Pigments, mineral: Ocher, crude	5,957	6,630	6,199	7,532	7,600
Precious and semiprecious stones except diamond, crude and worked:[11]					
Agate kilograms	1,929,158	1,346,803	1,770,874	1,595,201	NA
Amethyst do	182,324	202,338	357,384	328,007	NA
Aquamarine do	559	1,179	2,546	1,564	NA
Cat's-eye do	—	12	68	3	NA
Citrine do	24,250	33,830	49,796	60,858	NA
Emerald do	2,991	2,266	16,729	7,471	NA
Garnet do	211	177	2,907	840	NA
Opal do	513	342	619	1,383	NA
Ruby value	$403	$5,500	$505	$7,504	NA
Sapphire kilograms	([12])	—	1	([12])	NA
Topaz do	4,743	3,850	4,231	15,741	NA
Tourmaline do	2,838	526	2,536	2,144	NA
Turquoise value	$80	$4,221	—	$337	NA
Other kilograms	742,433	524,602	482,769	406,379	NA
Quartz crystal, all grades[11]	2,038	1,609	2,406	4,743	NA
Salt, marine thousand tons	2,473	2,481	2,727	2,866	2,900
Silica (silex)	3,620	3,594	5,721	7,005	NA
Sodium compounds:					
Caustic soda	257,016	[r]291,212	289,233	645,143	NA
Soda ash, manufactured (barilla)	150,012	141,022	120,651	118,659	130,000
Stone, sand and gravel:					
Dimension stone:					
Marble, rough-cut	105,240	145,257	160,229	177,290	NA
Slate	1,337	4,670	186,995	34,957	NA
Crushed and broken stone:					
Basalt thousand tons	NA	NA	324	198	NA
Calcareous shells	272,357	246,240	243,153	1,002,692	NA
Dolomite thousand tons	1,599	1,663	1,092	1,712	NA
Gneiss do	NA	NA	2,012	1,230	NA
Granite[13] do	56,077	51,815	NA	NA	NA
Limestone do	34,883	39,303	46,283	44,664	NA
Quartz[14]	34,821	45,530	95,720	57,920	NA
Quartzite:					
Crude	276,036	255,247	212,066	379,253	NA
Processed[15]	149,261	148,304	109,497	50,358	NA
Shale	326,923	529,449	540,381	587,428	NA
Sand thousand tons	3,833	4,875	NA	NA	NA
Sulfur, elemental, byproduct	29,864	44,351	57,176	103,727	201,000
Talc and related materials:					
Talc, marketable product[4]	141,035	180,474	190,674	310,397	255,000
Pyrophyllite, marketable product[4]	72,813	73,408	69,846	55,081	55,000
Other: Agalmatolite, marketable product	65,634	71,541	68,624	101,281	NA
Vermiculite:					
Crude	1,008	6,833	19,611	10,496	17,640
Marketable product[4]	1,008	3,617	4,031	7,382	8,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	103,000	110,000	NA	NA	NA
Coal, bituminous (marketable)[4] thousand tons	3,310	[r]3,646	5,050	7,604	8,300
Coke, metallurgical, all types do	2,805	3,349	3,417	3,930	[3]4,049
Gas, natural:					
Gross million cubic feet	57,909	63,835	68,271	67,045	[3]77,868
Marketed do	26,052	37,311	40,074	[e]43,000	50,000
Natural gas liquids thousand 42-gallon barrels	1,906	2,050	2,088	2,012	[3]2,063
Petroleum:					
Crude do	62,932	[r]60,740	60,615	62,444	[3]68,496

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products:					
Gasoline -- thousand 42-gallon barrels	90,013	82,692	89,944	84,780	[3]68,301
Jet fuel ---------- do	11,152	11,252	25,484	20,046	[3]20,278
Kerosine ---------- do	4,264	4,522			[3]4,095
Distillate fuel oil ---------- do	87,737	96,624	106,927	111,091	[3]121,846
Residual fuel oil ---------- do	98,725	[r]101,801	111,959	113,179	[3]105,392
Lubricants ---------- do	2,252	2,378	3,664	3,285	[3]4,233
Other ---------- do	44,546	[r]48,897	62,354	85,253	[3]69,692
Refinery fuel and losses ---------- do	9,705	9,774			[3]11,252
Total ---------- do	348,394	357,940	400,332	417,634	[3]405,089

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Oct. 13, 1981.

[2]In addition to the commodities listed, molybdenite, bismuth, and uranium oxide are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Figure represents sum of (1) crude material sold directly and (2) production of concentrate. (Sale of crude material in any given year may exceed production in that year as a result of the sale of stocks of crude material mined but not sold or beneficiated in previous years. Similarly, output of concentrates in any given year may exceed the amount of crude material mined in that year owing to treatment of previously mined but not yet processed ores.

[5]Represents total estimated production, including the amount reported as sold by the Garimpos to Government agencies.

[6]Includes sponge iron as follows, in thousand metric tons: 1976—262; 1977—358; 1978—270; 1979—324; 1980—275.

[7]Smelter and/or refined metal.

[8]Includes baddeleyite-caldasite.

[9]Figures represent officially reported output plus official Brazilian estimates of output by nonreporting miners; officially reported output was as follows, in thousands of carats: 1976—76; 1977—65; 1978—86; 1979—83.

[10]Includes the following quantities sold directly without beneficiation, in metric tons: 1976—110; 1977—2,650; 1978—6,051; 1979—5,177; 1980—not available.

[11]Exports.

[12]Less than 1/2 unit.

[13]Listed under dimension stone in previous editions, but only a small part of the 1976 total and none of the output for the other years was dimension stone. Data on output in gravimetric units are not available for 1978 and later years but output on a volumetric basis was reported as follows, in thousand cubic meters: 1978—37,842; 1979—42,684; 1980—not available.

[14]Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional unreported quantities of common quartz.

[15]Produced from a portion of the crude quartzite listed above; crude quartzite processed was as follows, in metric tons: 1976—206,036; 1977—157,531; and 1978-80—not available.

TRADE

The overall trade deficit in 1980 was the same as that of 1979. Total exports increased 32% to $20.1 billion while imports increased 28% to $23.0 billion. Brazil's imports of oil and other fuels increased in value almost 50% to $10.2 billion. Exports of iron ore in 1980 valued at $1.6 billion were, by far, the country's most important mineral export accounting for about 8% of the total.

DNPM's annual report shows that in 1979 Brazil's trade deficit in mineral commodities continued to grow. Total mineral imports (including petroleum) were valued at $9.8 billion while mineral exports were valued at $2.7 billion. If mineral fuels (oil and natural gas) are eliminated, Brazil had a surplus of $706 million in its mineral trade. Mineral imports in 1979 comprised crude oil, 68%; steel and ferroalloys, 5%; copper, 4%; and coal 3%. Mineral exports comprised iron ore, 86%; manganese, 4%;

and gems and diamond, 2.7%. Exports of steel and ferroalloys in 1979 amounted to $825 million and petroleum products were $212 million. In 1980, Brazil became a significant exporter of bauxite for the first time.

Brazil's mineral trade shows a trend away from simple beneficiated ore toward exports of mineral-related, semimanufactured commodities such as crude steel and ferroalloys with value added by further processing. The proportion of these commodities had increased from 28% of total mineral exports in 1977 to 45% in 1979.

Brazil's major partners in mineral trade in 1979, including mineral fuels, are shown below in million U.S. dollars:

Export markets		Import sources	
Japan	500	Iraq	2,283
United States	363	Saudi Arabia	1,945
Germany, Federal Republic of	252	United States	902
Argentina	168	Iran	884
Italy	104	Kuwait	295
Great Britain	100	Germany, Federal Republic of	251
Zaire	88	Venezuela	232
Colombia	84	Canada	210
Belgium-Luxembourg	80	Arab Emirates	150
France	74	South Africa	137

Table 2.—Brazil: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	4,005	516,153	168,251	Canada 299,285; Trinidad and Tobago 41,855.
Oxide and hydroxide	772	584	28	Argentina 225; Japan 119; Uruguay 110.
Metal including alloys:				
Unwrought	2	--		
Semimanufactures	1,310	4,224	1,277	Chile 970; Argentina 752; Panama 171.
Antimony metal including alloys, all forms	5	4	--	All to Uruguay.
Beryl ore and concentrate	739	452	450	United Kingdom 2.
Chromium:				
Chromite	81,859	45,215	--	Japan 45,157; Chile 50.
Oxide and hydroxide	50	50	--	All to United Kingdom.
Cobalt metal including alloys, all forms	NA	50	4	Netherlands 46.
Columbium and tantalum ore and concentrate:				
Columbite[1]	20	48	39	Netherlands 9.
Tantalite	112	280	109	West Germany 109; Netherlands 56.
Copper:				
Matte including cement	1,536	1,645	--	West Germany 800; Belgium-Luxembourg 800.
Metal including alloys, all forms	3,405	4,763	2,015	Uruguay 706; Colombia 339.
Gold metal including alloys, unwrought and partly wrought, troy ounces	2,781	--		
Iron and steel:				
Ore and concentrate including roasted pyrite, thousand tons	66,371	75,588	3,114	Japan 26,113; West Germany 12,403; France 4,285.
Metal:				
Pig iron, do.	1,026	989	154	Argentina 212; China, mainland 203.
Sponge iron, powder, shot	571	1,097	(2)	Uruguay 456; Argentina 317; Venezuela 149.
Ferroalloys:				
Ferrochrome	42,393	48,205	6,100	Japan 34,000; Belgium-Luxembourg 7,650.
Ferromanganese	40,115	40,256	25,310	Canada 10,500; Colombia 2,891.
Ferromolybdenum	842	426	60	Netherlands 315; Japan 40.
Ferrosilicon	12,308	19,642	9,612	Netherlands 3,854; Venezuela 2,380; Colombia 1,072.
Ferrocolumbium	10,852	12,787	3,623	Netherlands 3,216; Japan 1,678; Canada 830.
Other	41,004	47,993	19,172	Japan 9,244; China, mainland 7,500.
Steel, primary forms	332,973	478,318	53,381	Greece 235,329; United Kingdom 56,633; Argentina 56,358.

See footnotes at end of table.

Table 2.—Brazil: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	382,320	383,685	64,568	Nigeria 60,486; Colombia 55,017; Uruguay 49,534.
Universals, plates, sheets	148,868	444,484	195,343	Uruguay 49,879; Canada 38,962; Japan 28,544.
Hoop and strip	768	6,020	--	Argentina 2,118; West Germany 1,539; Uruguay 862.
Rails and accessories	95	4,115	--	Bolivia 3,998.
Wire	18,675	24,058	1,126	Colombia 11,483; Nigeria 5,207.
Tubes, pipes, fittings	53,134	150,480	43,947	Mexico 46,005; China, mainland 8,421; Argentina 5,625.
Castings and forgings, rough	341	887	535	Argentina 105; Costa Rica 82.
Lead:				
Pentoxide	NA	1	--	All to Argentina.
Metal including alloys, all forms	(2)	247	--	Uruguay 142; Argentina 100.
Manganese:				
Ore and concentrate thousand tons	894	1,187	100	Japan 163; United Kingdom 153; Norway 140.
Oxide	978	1,822	--	Argentina 1,000; Colombia 570.
Molybdenum metal including alloys all forms kilograms	170	196	--	All to Mexico.
Nickel metal including alloys, all forms	7	6	5	NA.
Platinum-group metals including alloys, unwrought and partly wrought:				
Platinum troy ounces	17,458	3 1,511	--	Spain 1,286.
Rare-earth metals:				
Oxide	530	120	78	Austria 25; United Kingdom 17.
Metals including alloys, all forms: Cerium	29	4	--	All to Argentina.
Silicon metal	NA	1,759	--	Japan 1,300; Argentina 237.
Silver metal including alloys, unwrought and partly wrought troy ounces	257	2,765	--	Paraguay 1,608; Mexico 964.
Tin metal including alloys, all forms	3,756	4,727	3,510	Argentina 451; Venezuela 281.
Titanium oxides kilograms	--	560	--	All to Venezuela.
Tungsten:				
Ore and concentrate	992	538	--	Sweden 240; West Germany 238.
Metal including alloys, all forms kilograms	25,000	435	--	All to Mexico.
Zinc:				
Ore and concentrate	5,688	9,108	--	Belgium-Luxembourg 6,176; Algeria 2,933.
Oxide and hydroxide	13	17	--	Mainly to France.
Metal including alloys, all forms	49	103	--	Mozambique 80; Uruguay 17.
Other:				
Ores and concentrates	861	--		
Ash and residue containing nonferrous metals	383	3,521	65	West Germany 3,096; Netherlands 163.
Oxides, hydroxides, peroxides kilograms	2,000	560	--	All to Ecuador.
Waste and sweepings of precious metals value, thousands	$882	$1,044	$767	West Germany $277.
Metals:				
Pyrophoric alloys	593	601	--	Japan 114; Austria 80; Netherlands 70; Norway 70.
Metalloids	2,201	--		
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	1	51	--	Mainly to Japan.
Artificial corundum	9,594	13,648	560	Japan 4,018; Argentina 3,648; Mexico 3,229.
Grinding and polishing wheels and stones	845	1,124	90	Philippines 171; Hong Kong 171; Chile 141.
Asbestos, crude	30	(2)	--	All to Bolivia.
Barium: Natural compounds	34,000	43,520	27,537	Trinidad and Tobago 7,781; Nigeria 4,500.

See footnotes at end of table.

Table 2.—Brazil: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Boron:				
Crude natural borates kilograms	5,000	700	--	All to Canada.
Oxide and acid do	140	1,250	--	Paraguay 1,000; Uruguay 250.
Cement	144,172	215,244	--	Paraguay 138,156; Argentina 40,592; Bolivia 36,376.
Clays and clay products:				
Crude clays:				
Bentonite	344	23	--	Argentina 15; Paraguay 8.
Kaolin	21,445	46,543	--	Netherlands 27,000; Italy 9,550; Uruguay 2,090.
Other	3,231	4,914	--	Italy 3,283; Uruguay 1,455.
Products:				
Refractory including nonclay brick	13,941	18,185	--	Argentina 5,665; Romania 3,551; Colombia 1,756.
Nonrefractory	40,271	80,882	2,420	Paraguay 40,252; Argentina 20,038.
Diamond:				
Gem, not set or strung value, thousands	$4,412	$1,044	$600	Belgium-Luxembourg $202; Switzerland $74; Israel $56.
Industrial do	--	$4	--	All to Netherlands.
Fertilizer materials:				
Manufactured:				
Nitrogenous	2,430	177	--	Bolivia 100.
Phosphatic	3,358	7,031	--	Argentina 4,000; Uruguay 1,500; Paraguay 1,072.
Potassic	100	1,732	--	Uruguay 1,612.
Other including mixed	4,357	8,627	--	Argentina 4,520; Uruguay 3,857.
Ammonia	145	108	--	Uruguay 69; Paraguay 38.
Feldspar, fluorspar, etc	2,500	--	--	
Graphite, natural	1,026	3,437	2,765	Japan 417; Argentina 182.
Gypsum and plasters	15	48	--	All to Paraguay.
Lime	6,444	8,842	--	Paraguay 6,812; Argentina 2,000.
Magnesite	56,219	104,399	5,700	Poland 60,650; India 10,000; Argentina 7,020.
Mica:				
Crude including splittings and waste	4,553	4,074	468	United Kingdom 1,527; West Germany 777; Belgium-Luxembourg 650.
Worked including agglomerated splittings kilograms	110	1,753	--	Argentina 1,700.
Pigments, mineral: Processed iron oxides	56	275	20	Paraguay 90; Argentina 80; Chile 64.
Precious and semiprecious stones except diamond:				
Agate	1,771	1,595	546	West Germany 387; Japan 256.
Amethyst kilograms	357,384	328,007	48,115	Japan 92,622; West Germany 73,042.
Aquamarine do	2,546	1,564	113	West Germany 812; Republic of South Africa 275; Japan 272.
Cat's eye do	68	[4]3	--	Mainly to Senegal.
Citrine do	49,796	60,858	11,475	West Germany 16,700; France 12,708; Japan 5,747.
Emerald do	16,729	7,471	6,918	India 296; Republic of South Africa 98.
Garnet do	2,907	840	125	West Germany 395; Republic of South Africa 168; Thailand 80.
Opal do	619	1,383	1,086	West Germany 271.
Ruby do	1	[5]20	--	All to India.
Topaz do	4,231	15,741	14,505	West Germany 621; United Kingdom 227.
Tourmaline do	2,536	2,144	53	West Germany 1,170.
Other do	482,737	406,379	27,505	West Germany 228,873; Hong Kong 33,581.
Salt and brine	111,684	138,240	95,790	Hungary 15,510; Nigeria 12,800.
Sodium and potassium compounds, n.e.s	17,204	37,953	--	Argentina 17,555; Uruguay 9,623; Venezuela 7,342.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	70,146	85,270	350	Italy 53,154; Japan 20,259.
Worked	2,864	4,179	316	Japan 2,168; Paraguay 300.
Dolomite, chiefly refractory grade	800	5	--	All to Ecuador.
Gravel and crushed rock	11,230	1,471	--	Bolivia 1,370; Argentina 48.
Limestone excluding dimension	1,110	2,698	--	Paraguay 2,350; Uruguay 348.
Quartz and quartzite	2,492	4,764	224	West Germany 1,628; Belgium-Luxembourg 1,262; Poland 700.
Sand excluding metal-bearing	1	701	--	Argentina 700.

See footnotes at end of table.

Table 2.—Brazil: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sulfur:				
Elemental, colloidal	15	--		
Sulfuric acid, oleum	228	15,839	--	Spain 14,530; Uruguay 1,200.
Talc, steatite, soapstone, pyrophyllite	159	320	--	Argentina 156; Paraguay 50; Colombia 42.
Vermiculite	--	17	--	Bolivia 11; Uruguay 4.
Other:				
Crude	8	1,163	(2)	Japan 1,075.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	5,778	122	--	Paraguay 121.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural kilograms	3,000	75	--	All to Paraguay.
Carbon black do	9	4,376	--	Chile 2,200; France 2,000.
Coal, all grades including briquets	25	125	--	All to Argentina.
Hydrogen, helium, rare gases	2,515	189	--	Argentina 182.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	3,130	--		
Refinery products:				
Gasoline, motor do	5,118	4,709	--	Colombia 2,393; Netherlands Antilles 748; Zaire 700.
Kerosine do	1,208	1,773	--	Zaire 1,135; Nigeria 264.
Distillate fuel oil do	2,739	1,965	--	Paraguay 306; Congo 212; Nigeria 170.
Residual fuel oil do	113	66	--	All to Argentina.
Lubricants do	24	6	--	Paraguay 5.
Other:				
Liquefied petroleum gas do	250	739	--	Paraguay 163; Argentina 118; Morocco 86.
Mineral jelly and wax do	75	100	27	United Kingdom 17; Peru 12; Mexico 8.
Nonlubricating oils do	2	--		
Bitumen do	85	66	--	Paraguay 56.
Bituminous mixtures do	6	27	--	Bolivia 21.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r1,725	3,868	--	Argentina 2,979; Uruguay 826.

rRevised. NA Not available.
[1]May include some tantalum.
[2]Less than 1/2 unit.
[3]Excludes an unreported quantity valued at $1,787.
[4]Excludes an unreported quantity valued at $781,425.
[5]Excludes an unreported quantity valued at $5,229.

Table 3.—Brazil: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	10,091	15,574	(1)	Guyana 14,934; United Kingdom 640.
Oxide and hydroxide	24,335	70,614	446	Suriname 36,281; India 32,400.
Metal including alloys:				
Scrap	22,333	22,764	15,752	Canada 3,200; Norway 3,183.
Unwrought	r83,029	51,816	6,169	Suriname 16,068; Canada 7,259; Italy 3,858.
Semimanufactures	11,524	17,928	10,706	West Germany 3,473.
Antimony:				
Ore and concentrate	654	1,641	(1)	Bolivia 1,446; Peru 104.
Trioxide and pentoxide	392	597	18	Belgium-Luxembourg 262; United Kingdom 210.
Metal including alloys, all forms	284	177	--	Bolivia 80; Mexico 59.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Arsenic:				
Trioxide, pentoxide, acid	601	860	4	Mexico 390; West Germany 167; United Kingdom 97.
Metal including alloys, all forms	39	59	35	Sweden 18.
Beryllium metal including alloys, all forms—kilograms	5	8	--	France 6.
Bismuth:				
Trioxide and pentoxide —do	167	194	93	Mexico 100.
Metal including alloys, all forms	35	44	(1)	Mexico 31; Peru 11.
Cadmium:				
Oxide	181	108	(1)	Mexico 56; Belgium-Luxembourg 12.
Metal including alloys, all forms	55	248	(1)	Mexico 211; Peru 27.
Chromium:				
Chromite	18,650	24,575	--	Philippines 20,800; Republic of South Africa 3,775.
Oxide and hydroxide	347	429	(1)	Poland 251; West Germany 141.
Metal including alloys, all forms	99	130	1	Japan 86; United Kingdom 16.
Cobalt:				
Ore and concentrate	--	5	--	All from West Germany.
Oxide and hydroxide	86	52	--	United Kingdom 27; Belgium-Luxembourg 14; West Germany 10.
Metal including alloys, all forms	312	237	22	Belgium-Luxembourg 171; Netherlands 20.
Copper:				
Sulfate	4,058	4,526	(1)	Peru 3,425; Chile 605; Mexico 335.
Metal including alloys:				
Scrap	1,303	2,326	2,323	NA.
Unwrought	156,998	190,225	10,228	Chile 116,579.
Semimanufactures	1,673	1,357	566	United Kingdom 289; Japan 152.
Gold:				
Ore and concentrate value, thousands	$24,433	$56,436	$6,473	Canada $25,653; West Germany $22,724.
Metal including alloys, unwrought and partly wrought troy ounces	112,334	150,530	15,593	France 90,440; Switzerland 21,380.
Iron and steel:				
Ore and concentrate	8	27	23	NA.
Metal:				
Scrap	29	30	29	NA.
Sponge iron, powder, shot	7,044	7,694	5,381	West Germany 1,676.
Ferroalloys	3,103	1,555	310	Sweden 559; France 213.
Steel, primary forms	73,847	115,652	89	Japan 35,114; West Germany 13,809; Argentina 12,699.
Semimanufactures:				
Bars, rods, angles, shapes, sections	29,244	36,720	735	United Kingdom 16,554; West Germany 5,869; Japan 5,616.
Universals, plates, sheets	437,712	361,400	25,102	France 106,643; Japan 82,934; West Germany 55,319.
Hoop and strip	11,185	8,188	1,353	West Germany 2,569; Japan 1,974; Sweden 646.
Rails and accessories	124,896	17,574	1,771	Japan 6,227; Italy 4,413; West Germany 3,158.
Wire	4,038	6,665	183	Uruguay 3,822; Japan 1,725; West Germany 470.
Tubes, pipes, fittings	54,245	48,779	3,718	Japan 23,305; Italy 5,405; West Germany 4,013.
Castings and forgings, rough	859	398	35	West Germany 197; Italy 90.
Lead:				
Ore and concentrate	44,765	41,994	14,507	Greenland 10,967; Canada 8,495.
Oxide and hydroxide	426	310	1	Mexico 308.
Metal including alloys, all forms	755	2,586	1,960	Peru 600.
Lithium hydroxide	316	356	351	West Germany 5.
Magnesium metal including alloys, all forms	11,504	13,339	8,541	Norway 4,671.
Manganese:				
Ore and concentrate	62,277	101,395	3,138	Gabon 74,350; Republic of South Africa 15,000.
Oxide and hydroxide	r308	155	(1)	West Germany 106; Japan 40.
Metal including alloys, all forms	746	1,105	51	Republic of South Africa 889; Japan 158.
Mercury 76-pound flasks	4,188	4,596	1,060	Mexico 3,433.
Molybdenum:				
Ore and concentrate	2,874	8,534	6,353	Chile 2,051.
Hydroxide and trioxide	89	45	--	Mainly from Chile.
Metal including alloys, all forms	43	208	25	Sweden 156.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Oxide and hydroxide	161	42	41	NA.
Matte, speiss, similar materials	302	1,499	963	France 330; Australia 200.
Metal including alloys:				
Unwrought	3,017	3,080	1,474	Norway 581; Republic of South Africa 532.
Semimanufactures	855	894	184	West Germany 295; France 182.
Platinum-group metals:				
Ore and concentrate ... value	$270,172	$303,908	--	West Germany $185,989; Canada $117,919.
Metals including alloys, unwrought and partly wrought:				
Platinum ... troy ounces	3,697	9,710	2,572	Netherlands 4,147; West Germany 1,897.
Others ... do	r16,397	17,490	3,215	West Germany 7,427; Netherlands 5,466.
Rare-earth metals:				
Metals	3	NA	NA	NA.
Cerium oxide	23	NA	NA	NA.
Selenium, elemental	34	32	(1)	Chile 18; Peru 9.
Silicon metal	21	10	9	NA.
Silver metal including alloys, unwrought and partly wrought thousand troy ounces	6,030	6,928	141	Mexico 2,737; Peru 2,384.
Sodium metal	22	18	(1)	United Kingdom 9; West Germany 8.
Tellurium, elemental ... kilograms	968	485	--	Peru 480.
Tin:				
Ore and concentrate	4,074	7,542	--	Bolivia 6,138; Singapore 1,395.
Oxide and hydroxide	97	37	(1)	United Kingdom 29; Italy 7.
Metal including alloys, all forms	21	12	2	Netherlands 7.
Titanium:				
Ore and concentrate:				
Ilmenite	56,335	56,437	--	All from Australia.
Rutile	4,070	2,942	--	Australia 2,932.
Other	50	--		
Oxide and hydroxide	5,520	9,414	72	West Germany 7,708; France 699.
Metal including alloys, all forms	73	130	110	Belgium-Luxembourg 8.
Tungsten:				
Hydroxide and trioxide kilograms	49	4	1	West Germany 3.
Metal including alloys, all forms	59	36	19	West Germany 11.
Uranium and thorium oxides including rare-earth oxides	r26	101	63	France 21; West Germany 11.
Vanadium:				
Oxide	796	1,215	97	Republic of South Africa 546; Finland 269; West Germany 261.
Metal including alloys, all forms kilograms	3	40	--	All from West Germany.
Zinc:				
Ore and concentrate	--	11	--	Do.
Oxide and hydroxide	458	325	8	Uruguay 200; West Germany 49; Argentina 30.
Metal including alloys:				
Unwrought	67,364	60,058	--	Mexico 22,046; Peru 16,871; Canada 16,563.
Semimanufactures	21	61	9	Belgium-Luxembourg 46.
Zirconium and hafnium:				
Ore and concentrate	11,194	1,249	--	Australia 810; West Germany 312.
Oxide	243	392	6	West Germany 264; United Kingdom 122.
Other:				
Ores and concentrates kilograms	r61	158	--	All from Canada.
Ash and residue containing nonferrous metals	6,245	7,115	5,408	Canada 1,107..
Oxides, hydroxides, peroxides	r568	916	202	West Germany 635.
Metals:				
Alkali and alkaline-earth metals	r3	13	2	West Germany 10.
Metalloids	r(1)	11	(1)	France 10.
Pyrophoric alloys	r1	14	--	All from Switzerland.
Base metals including alloys, all forms	r1	5	(1)	West Germany 3.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	837	663	402	Italy 213.
Artificial corundum	593	1,265	221	France 504; West Germany 371.
Dust and powder of precious and semiprecious stones kilograms	416	444	269	West Germany 113.
Grinding and polishing wheels and stones	431	323	110	West Germany 73; Italy 35; Austria 28.
Asbestos, crude	37,651	35,763	177	Canada 24,649; Republic of South Africa 8,028.
Barite and witherite	240	156	51	United Kingdom 80; West Germany 20.
Boron materials:				
Crude natural borates	20,247	9,625	1,518	Argentina 6,280; Netherlands 1,499.
Oxide and acid	7,333	4,812	2,459	Chile 1,160; Argentina 591.
Bromine	34	32	(1)	Israel 31.
Cement	179,827	100,700	724	Uruguay 75,160; Colombia 16,800.
Chalk	680	611	--	Belgium-Luxembourg 447; France 114.
Clays and clay products:				
Crude clays:				
Bentonite	14,354	21,594	14,629	Argentina 6,995.
Kaolin	2,453	3,308	3,202	United Kingdom 81.
Other	2,160	3,022	2,410	France 600.
Products:				
Refractory including nonclay brick	35,141	14,821	1,767	United Kingdom 7,405; West Germany 2,367; France 1,125.
Nonrefractory	3,952	2,257	(1)	Italy 971; Uruguay 721.
Cryolite and chiolite	520	86	1	Denmark 85.
Diamond excluding dust:				
Gem, not set or strung value, thousands	r$2,187	$3,554	$159;	Belgium-Luxembourg $2,365; Israel $891.
Industrial carats	r385,000	210,000	25,000	Italy 105,000.
Diatomite and other infusorial earth	1,365	1,634	265	Mexico 688; West Germany 666.
Feldspar and fluorspar	24,637	6	--	All from Switzerland.
Fertilizer materials:				
Crude:				
Nitrogenous	45,319	21,800	--	All from Chile.
Phosphatic thousand tons	1,156	754	359	Morocco 297.
Manufactured:				
Nitrogenous ---do---	1,265	1,406	971	Netherlands 187; West Germany 185.
Phosphatic:				
Thomas slag	r9,900	11,840	--	Egypt 9,910; Belgium-Luxembourg 1,188.
Other	r360,818	411,366	319,585	Portugal 63,600.
Potassic thousand tons	1,661	1,830	478	Canada 608; East Germany 324.
Other including mixed	476,874	551,501	486,986	Chile 62,700.
Ammonia	224,124	172,167	44,977	Mexico 127,189.
Graphite, natural	96	112	4	Madagascar 91; West Germany 12.
Gypsum and plasters	958	628	3	Bolivia 615.
Iodine	166	130	(1)	Chile 79; Japan 51.
Lime	10	40	--	All from Belgium-Luxembourg.
Magnesite	7	48	6	Italy 42.
Mica:				
Crude including splittings and waste	6	99	3	France 80; United Kingdom 10.
Worked including agglomerated splittings	110	78	38	France 23.
Pigments, mineral, including processed iron oxides	2,358	2,597	115	West Germany 2,210.
Precious and semiprecious stones except diamond ---- kilograms	228	331	46	West Germany 204.
Pyrite, gross weight	103	81	41	West Germany 40.
Salt and brines	15	1	(1)	Mainly from United Kingdom.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	43,324	18,840	5,900	West Germany 5,616; France 2,834.
Caustic potash, sodic and potassic peroxides	2,153	2,558	635	Spain 535; West Germany 475.
Soda ash	184,229	200,702	43,162	France 97,156; West Germany 21,197.
Sodium sulfate	125,485	132,683	(1)	Mexico 110,828; Chile 21,850.

See footnotes at end of table.

Table 3.—Brazil: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	73	148	--	Mainly from Italy.
Other	23	(1)	--	All from West Germany.
Worked	124	81	--	Uruguay 44; Italy 26.
Dolomite, chiefly refractory grade	2,730	5,520	--	Uruguay 5,320.
Gravel and crushed rock	8	20	(1)	Mainly from United Kingdom.
Limestone excluding dimension	--	25,000	--	All from Netherlands.
Quartz and quartzite	6	19	11	West Germany 8.
Sand excluding metal-bearing	116	1,117	51	Argentina 960; West Germany 80.
Sulfur:				
Elemental:				
Other than colloidal	632,276	686,041	132,154	Canada 380,850; Poland 78,166.
Colloidal	278	317	305	West Germany 12.
Sulfur dioxide	27	97	97	
Sulfuric acid, oleum	44,391	26,112	1	Norway 26,109.
Talc, steatite, soapstone, pyrophyllite	131	111	105	Norway 5.
Vermiculite including expanded	182	--		
Other:				
Crude	1,145	6,520	1,364	Australia 4,396; Mexico 269.
Slag, dross, similar waste, not metal-bearing	674	1,411	--	United Kingdom 1,410.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	1,550	2,676	241	Japan 2,002.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	1,579	2,659	2,153	Uruguay 495.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	597	291	191	Argentina 100.
Carbon black and gas carbon:				
Carbon black	5,435	7,786	1,684	Argentina 3,740; West Germany 1,188.
Gas carbon kilograms	250	--		
Coal, all grades including briquets thousand tons	r3,640	4,479	2,554	Poland 1,283; Canada 495.
Coke and semicoke do	1,518	315	--	West Germany 234; United Kingdom 28.
Hydrogen, helium, rare gases	38	38	38	
Petroleum and refinery products:				
Crude thousand 42-gallon barrels	329,852	370,242	--	Iraq 150,360; Saudi Arabia 116,491; Iran 42,745.
Refinery products:				
Gasoline do	580	967	--	Netherlands Antilles 738; Canada 225.
Kerosine do	37	--		
Distillate fuel oil do	328	1,249	--	Netherlands Antilles 856; Venezuela 393.
Residual fuel oil do	1,088	1,301	20	Venezuela 721; Iran 225; Netherlands Antilles 174.
Lubricants do	2,056	1,861	1,069	Netherlands Antilles 313.
Other:				
Liquefied petroleum gas do	923	886	(1)	Mexico 556; Venezuela 262.
Mineral jelly and wax do	8	12	10	NA.
Nonlubricating oils do	r1,945	334	125	Romania 75; Saudi Arabia 65.
Petroleum coke do	997	1,018	569	Argentina 427.
Bitumen and other residues do	(1)	(1)	NA	NA.
Bituminous mixtures do	(1)	1	(1)	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	r164	138	135	Republic of South Africa 1.

rRevised. NA Not available.
1Less than 1/2 unit.

COMMODITY REVIEW

During 1980, DNPM published two important and basic mineral balance studies for Brazil covering metallic and nonmetallic minerals.[4] The studies include historical data on Brazil's supply-demand position during 1970-79 and projections of domestic supply and demand for 1980-89. Information on prices, international trade, and reserves are also included, as well as a bibliography for each mineral studied.

METALS

As a result of exploration activities by Government agencies and private companies, DNPM reported substantial increases in the measured reserves of a number of metallic minerals headed by uranium, 65%; and followed by beryllium, 63%; gold, 31%; tin, 30%; bauxite, 26%; tungsten, 18%; manganese, 12%; copper, 11%; titanium, 6%; and chromium, 5%.[5] Measured reserve figures published by DNPM are those that are officially approved by the Government on the basis of annual mine reports and final reports on exploration work.

Aluminum-Alumina-Bauxite.—In 1980, Brazil was the major producer of primary aluminum in Latin America and had one of the major world reserves of bauxite. Discoveries of large reserves of bauxite in the Amazon Basin in the recent past have increased reserve estimates to about 4.5 billion tons giving Brazil third rank in bauxite reserves after Guinea and Australia.

Despite remarkable success in increasing production of primary aluminum from 56,000 tons in 1970 to an estimated 260,000 tons in 1980, Brazil continued to import sizable amounts of aluminum, which in 1979 was 104,000 tons valued at $177 million.

Brazil's four major producers were expanding aluminum capacity from 278,000 to 470,000 tons in 1985 at plants in Sao Paulo, Minas Gerais, and Bahia. New projects planned in Rio de Janeiro, Pernambuco, Maranhão, and Pará would increase aluminum capacity by 540,000 tons in 1985 giving Brazil a total capacity of 1,010,000 tons. The supply-demand projections indicate that in 1985 Brazil would eliminate its dependency on foreign supply and become an exporter of aluminum, for the first time, of about 350,000 tons.[6]

DNPM estimates that by 1990 Brazil will produce 17 million tons of bauxite, 4.35 million tons of alumina, and 1.4 million tons of aluminum.

Valenorte Aluminio Ltda., a subsidiary of CVRD, acted as the holding company for CVRD's investments in Aluminio Brasileiro S.A. (ALBRAS), Alumina do Norte do Brasil S.A. (ALUNORTE), and Mineração Vera Cruz S.A. (MVC). MVC's 86,000-ton-per-year aluminum plant at Santa Cruz, Rio de Janeiro State, was 65% complete and scheduled for startup in early 1982.

Basic engineering was in progress for the 320,000-ton-per-year ALBRAS aluminum smelter to be constructed at Vila do Conde in Pará south of Belém. Drainage work and the construction of a paved road system were in progress and expected to be completed in 1981. The construction of the Bacarena Velha shipping pier was completed as well as the road link to the smelter site.

The $1.3 billion ALBRAS project is being financed by CVRD and a Japanese consortium, Nippon Amazon Aluminum (Nalco). According to the agreement made in June 1980, Nalco is to finance the entire first stage of 80,000 tons per year capacity due onstream in 1984, as well as the additional 80,000-ton-per-year capacity due in July 1985. CVRD will finance the third stage due in 1987 and the fourth stage in 1988. The entire aluminum output of ALBRAS will be exported.

At the Vila do Conde site, ALUNORTE was building its 800,000-ton-per-year alumina refinery for completion in 1985.

After obtaining Government approval, Alcoa Aluminio S.A., owned 68% by the Aluminum Co. of America (Alcoa) and 32% by Hanna Mining Corp. of Cleveland, Ohio, initiated work in August on the $1 billion complex comprising a 100,000-ton-per-year aluminum smelter and a 500,000-ton-per-year alumina refinery. The refinery and smelter were scheduled for startup in 1983 and 1984, respectively. The complex is sited at São Luis, Maranhão State, near the terminus of the railway link to Carajás.

Bauxite for the ALUNORTE and Alcoa projects will be supplied from the Trombetas operation.

Mineração Rio do Norte S.A. (MRN), a consortium of domestic and foreign companies led by CVRD, completed its first full year of operation of the Trombetas bauxite project in the Amazon Basin in Pará, west

of Belém. Output of bauxite from Trombetas in 1980 was 2.9 million tons, of which 2.8 million tons were exported. With the startup of Trombetas in mid-1979, Brazil became a significant exporter of bauxite, for the first time, of about 516,000 tons. Bauxite exports were estimated at 3.0 million tons and 3.3 million tons for 1980 and 1981, respectively.

In Brazil, production of aluminum has been growing at a rate of 15% per year since 1970, while apparent consumption has been growing at a rate of 13% per year.

Beryllium.—Brazil is the largest producer of beryl ore in Latin America and apparently has one of the largest reserves in the world. Brazil's reserves are located mostly in Galiléia, Minas Gerais, and Anagé, Bahia.

Brazil is the second most important world producer after the U.S.S.R. Brazil's beryl output has been in a steep decline since 1969 when 3,600 tons of beryl concentrate was produced. Practically all of the output is produced by small prospectors (garimpeiros), in connection with gem production. All of the recent output has been exported to the United States except in 1974 when a small amount went to Japan. During 1976-79, Brazil accounted for 48% of U.S. imports of beryl concentrate.

Chromium.—Cia de Ferro-Ligas da Bahia S.A. (FERBASA), a privately owned operation at Campo Formoso in Bahia State, continued as Brazil's major producer of chromite ore and the sole producer of ferrochromium. FERBASA's production of ferrochromium has been in a strong uptrend, as shown in table 4 in metric tons. In 1979, total exports of ferrochromium were valued at $19.6 million and was Brazil's second most valuable ferroalloy export after ferrocolumbium.

FERBASA was installing a new furnace to increase its capacity to produce high-carbon ferrochromium, which was scheduled for operation in early 1981.

In January a consortium of Japanese companies sold its 48% interest in the chromite mine of Mineração Serra da Jacobina S.A.. The Japanese withdrew from the joint venture with FERBASA because of heavy losses since the joint venture was initiated in 1972. The mine opened in 1976.

Table 4.—Brazil: Production and exports of ferrochromium by FERBASA

(Metric tons)

	Production			Exports		
	1978	1979	1980	1978	1979	1980
Ferrochromium, high-carbon	56,326	74,435	79,894	42,370	48,200	45,871
Ferrochromium, low-carbon	5,844	10,079	13,549	--	--	--
Ferrosilicochromium	4,698	7,239	8,086	--	--	--
Total	66,868	91,753	101,529	42,370	48,200	45,871

Source: Associacão Brasileira dos Produtores de Ferro-ligas (ABRAFE). Anuario da industria brasileira de ferro-ligas, 1981.

Columbium (Niobium).—Brazil has the world's largest reserves of columbium minerals (pyrochlore) located mostly in Araxá and Tapira in Minas Gerais. As Brazil expanded its production of ferrocolumbium, exports of pyrochlore concentrate continued to decline. In 1979, exports of concentrate, valued at $5.4 million, represented 6% of total concentrate output compared with a 20% share exported in 1977. On the other hand, exports of ferrocolumbium continued to expand, increasing in volume and value. Exports of ferrocolumbium were valued at $83 million in 1979 and represented Brazil's most valuable ferroalloy export. Most of Brazil's export in 1980 went to the United States, Italy, Sweden, and Japan.

Table 5 shows the output by Brazil's two producers of ferrocolumbium. Catalão initiated production in 1977 and exports 90% of its output. DNPM projections indicate that domestic demand for ferrocolumbium will grow moderately until 1989 and Brazil will continue to have a substantial surplus for export.

Companhia Brasileira de Metalurgia e Mineração (CBMM), which has been mining about 2,500 tons per day of pyrochlore ore on a two-shift basis for an annual ore production of 875,000 tons, progressed with its expansion program for ore treatment facilities. Nominal capacity of these facilities to treat 800,000 tons per year of ore containing an average of 3% Cb_2O_5 to produce 27,600 tons per year of concentrate with 60% Cb_2O_5 was being increased to

44,000 tons per year of concentrate in 1981 and 60,000 tons per year in 1982.

CBMM moved further into provision of only upgraded forms of columbium by inaugurating commercial shipments of technical-grade (98% minimum Cb_2O_5) columbium oxide in January and by ending exports of concentrate as of yearend 1980. The company was reported to be considering future production of columbium metal.

Table 5.—Brazil: Production and exports of ferrocolumbium

(Metric tons)

Company	Production			Exports[e]		
	1978	1979	1980	1978	1979	1980
Companhia Brasileira de Metalurgia e Mineração (CBMM)	8,485	11,860	15,370	8,916	11,360	12,160
Mineração Catalão de Goias S.A. (Catalão)	1,766	2,053	2,160	1,590	1,850	1,944
Total	10,251	13,913	17,530	10,506	13,210	14,104

[e]Estimated.

Source: ABRAFE Yearbook 1981.

Copper.—Brazil continued to rely entirely on imports to meet its demand for primary copper. According to DNPM projections contained in Brazil's mineral balance,[7] demand for copper is expected to grow 11% per year until 1989 when total domestic demand is expected to reach 647,000 tons. At that time new mine, smelter, and refinery projects are expected to contribute 300,000 tons. Together with production of secondary copper from scrap, Brazil's dependency on foreign sources would be reduced to 29% of domestic demand.

In Bahia, the $783 million mine, smelter, and refinery project of Caraiba Metais S.A., Industria e Comercio, controlled by Insumo Básicos, Financiamentos e Participações S.A. (FIBASE) a subsidiary of the Banco Nacional do Desenvolvimento (BNDE), was nearing completion. In the first stage, scheduled to be completed in 1982, a capacity of 65,000 tons per year of copper would be available to be expanded to 150,000 tons per year after 1983.

The copper refinery under construction in Rio Grande do Sul by a joint venture of Eluma S.A. and Noranda Mines Ltd. was rescheduled for completion in 1985 with a capacity of 60,000 tons per year in the first stage. The second stage capacity of 150,000 tons per year would be obtained in 1987. Noranda will supply technology and 60% of the imports of copper concentrate required.

The Government included copper development in its 10-year investment program to exploit the several minerals in the Carajás Mineral Province. The large copper deposits discovered in the vicinity of the deposits of iron ore, manganese, and bauxite would be exploited on the basis of energy, railway, and port facilities put in place to produce iron ore in the first phase.

Gold.—The sharp rise in the price of gold in 1979-80, and the discovery of an apparently large deposit at Serra Pelada, created intense interest in gold exploration in Brazil. This was manifested by the large number of exploration licenses granted by DNPM in the last 2 years for exploration in the States of Amazonas, Bahia, Goiás, Maranhão, Mato Grosso, Minas Gerais, Rio Grande do Sul, and Pará.

Geologic studies on the Serra Pelada deposit located in the southern part of the Carajás Mineral Province, Pará State, were undertaken by Rio Doce Geologia e Mineração S.A., the exploration subsidiary of CVRD. Preliminary studies of Serra Pelada indicate gold reserves of 33,000 tons, substantially above current reserve estimates for all of Brazil. As of the end of 1979, DNPM reported total measured reserves for Brazil at 195 tons located primarily in the municipalities of Mariana and Nova Lima in Minas Gerais.

In the latest available minerals report DNPM stated 1979 gold output at 4.46 tons, of which 3.33 tons were from mine operations by Morro Velho Mineração S.A. and Mineração Tejucana S.A., and 1.13 tons were from many garimpeiros. DNPM noted that the output of the garimpeiros represents only the amount purchased by local agencies of the Federal Government. In its report, "Gold 1981," Consolidated Gold Fields Ltd. estimated Brazil's 1979 and 1980 gold production at 25 tons and 35 tons, respectively. Bureau of Mines estimates in

table 1 are conservative.

The major mine producer, Morro Velho, operated an underground mine at its complex near Belo Horizonte, Minas Gerais. Tejucana operated dredges on Rio Jequitinhonha and Rio das Velhas, and the aluvial deposit at Ribeirão do Carmos in Mariana, Minas Gerais. The garimpeiros operated primarily in the Amazon Basin, the region of Tapajós and Rio Madeira in Rondonia, in Lourenço and Calçoene in Amapá, Serra Pelada in Pará, the region of Rio Guaporé (Vila Bela) in Mato Grosso do Norte, and the region of Rio Maués in Amazonas State.

Brazil's apparent demand for gold, mostly for jewelry, was 16 tons in 1978 and 22 tons in 1979. In 1979, about 80% of domestic demand for gold was imported at a cost of $72 million, most of which was gold ore from Canada and the Federal Republic of Germany.

Iron Ore.—The outstanding event in 1980 was the decision of the Government in October to give priority status to the execution of the Carajás iron ore project in Pará State. The $4.9 billion project is part of the $61 billion comprehensive development program for the Carajás region for the decade ending 1990. The Carajás iron ore deposits of about 18 billion tons of ore has an average grade of 66% iron. Of total reserves at Carajás, 2.4 billion tons of iron ore are measured reserves. The deposit was discovered in 1967 by a subsidiary of United States Steel Corp. This company sold its 49.1% interest to CVRD in 1977 and withdrew its involvement in the Carajás project.

CVRD was implementing the Carajás project through its subsidiary Amazonia Mineração S.A. (AMZA). AMZA, formed in 1970 with United States Steel, was expected to be incorporated into CVRD in early 1981. At that time the project will be controlled within CVRD by the Superintendencia de Implementaçáo do Projeto Carajás, which reports to the Director of Planning.

New infrastructure will be required to support the Carajás iron ore project. Because of its remote location in the Amazon Basin, the project comprises in addition to the open pit mine proper, an 890-kilometer railroad to the Atlantic coast and a deep water port at Ponta da Madeira located between Itaqui and São Luis in Maranhão State. By yearend 1980, detailed engineering was nearing completion for the project.

Development of the open pit mine at Carajás is estimated to cost $515 million, representing 16% of the total base cost of the project of $3.27 billion. (The $4.9 billion estimate given above includes contingencies and interest during construction.) The mine is designed for an output of 35 million tons per year of beneficiated ore with eventual capacity of 50 million tons per year. Initial output scheduled for 1985 will be at the 15-million-ton-per-year rate and consist of 90% sinter feed and 10% natural pellets. The capacity of 35 million tons per year was programed for 1987. Initial mining operations will take place on the N4E deposit, one of the main iron ore bodies in the Carajás area, with 1.2 billion tons of measured reserves of high-grade ore. The proposed open pit mine will employ 2 large-hole rotary drills, 16-yard electric shovels, and 154-ton dump trucks.

A pilot beneficiation plant was completed at the Carajás mine site and trial beneficiation tests were planned for March 1981 to determine the final processing flowsheet. Beneficiation facilities will consist of three stages of crushing-screening, one rodmill stage, a solids recovery stage and a final dewatering stage. Belt conveyors will transport the beneficiated ore to the 1.6-million-ton storage yard.

The Carajás railroad will be used to transport iron ore from the N4E mine site to the Port of Ponta da Madeira for export. The railroad comprises 890 kilometers of single-track line, 11.1 kilometers of bridges including a long 2.3-kilometer bridge over the Tocantins River, and 8 small yards along the line. By yearend 1980, subgrade construction of the first 540 kilometers of the railroad was in progress. About 38% of the earthmoving work and 25% of the bridges and viaducts under contract were completed.

The proposed port for the Carajás project will be located in a sheltered bay about 10 kilometers from São Luis and 1 kilometer north of the existing Port of Itaqui. Adequate natural depth of water for 280,000-deadweight-ton ships is available alongside the proposed berth. Shipping facilities include two car dumpers and a 16,000-ton-per-hour linear shiploader. By yearend 1980, the relocation of the access highway to Itaqui was completed with 85% of the railroad access completed. Construction of two breakwaters to protect the future marine terminal was initiated during 1980 with about 10% completion by yearend.

Overall, by the end of 1980, CVRD had expended $308 million on the Carajás proj-

ect with $438 million budgeted for 1981. According to the Carajás financial plan, CVRD would contribute 48% of the requirements with the balance coming from Brazilian credit institutions and external sources. CVRD was negotiating with the International Bank for Reconstruction and Development (World Bank) for a $350 million loan.

As for market prospects, CVRD forecast a small deficit in iron ore supply in 1985 in worldwide markets taking into account Brazil's own new capacity of 61 million tons per year of iron ore (including Carajás) as well as the capacity increases by Australia, Guinea, Venezuela, the Republic of South Africa, and Peru. CVRD was aggressively negotiating long-term supply contracts with buyers in Japan, Italy, the Federal Republic of Germany, and South Korea, which by yearend 1980 amounted to about 22 million tons per year.

CVRD and other large iron ore producers were also expanding iron ore capacity in the iron quadrangle in Minas Gerais, Brazil's traditional iron ore source. Mineração Brasileiros Reunidos S.A. (MBR), Brazil's second largest iron ore producer was expanding capacity from 15.1 million tons per year in 1980 to 31 million tons per year in 1985-86. CVRD also participated in the Capanema project of Minas da Serra Geral S.A. that completed 20% of its 11.5-million-ton-per-year project scheduled for startup in 1982.

In 1980, Brazil continued as the second world producer of iron ore after the U.S.S.R. and the world's major exporter. CVRD was the world's largest producer and exporter of iron ore. Table 6 provides data on iron ore shipments during 1980 by some of Brazil's leading producers.

In its 1980 annual report, CVRD reported sustained growth in sales despite the slump in the world steel industry. CVRD reported that its total iron ore production increased 18% to 67.6 million tons of which 4.6 million tons were iron ore pellets. Exports of iron ore and pellets in 1980 by CVRD generated foreign exchange earnings of $792 million, a gain of 5% over 1979 despite a 7% decline in volume.

Brazil's total iron ore exports in 1980 of 78.9 million tons were composed of 49.0 million tons of fines, 17.3 million tons of pellets, and 12.6 million tons of lump ore. Iron ore pellets were produced by CVRD, Cía Nipo-Brasileira de Pelotização (NIBRASCO), Cía Italo-Brasileira de Pelotização (ITABRASCO), Cía Hispano-Brasileira de Pelotização (HISPANOBRAS), and Samarco Mineração S.A. (SAMARCO). The shipping ports used were Tubarão-Vitoria, Ponta do Ubu, Sepetiba, and Rio de Janeiro. In 1979, the United States imported only 3.1 million tons from Brazil; shipped by CVRD, SAMARCO, and MBR.

Table 6.—Brazil: Iron ore and pellet shipments by leading producers during 1980

(Thousand metric tons)

Company	For export	For domestic consumption	Total
Companhia Vale do Rio Doce (CVRD)	[1]44,506	6,400	50,906
Mineração Brasileiras Reunidas S.A. (MBR)	11,846	2,840	14,686
NIBRASCO, ITABRASCO, and HISPANOBRAS	8,965	--	8,965
Ferteco Mineração S.A	6,144	1,730	7,874
S.A. Mineração da Trindade (SAMITRI)	2,743	2,240	4,983
Samarco Mineração S.A.	4,067	203	4,270
Companhia Siderurgica Nacional (CSN)	--	3,000	3,000
Wm. H. Muller S.A. (sales)	140	1,015	1,155
Itaminas Comercio de Mineração S.A.	192	--	192
Mineração Prima S.A. - MIPRISA (PHIBRO)	167	--	167
Esperança S.A	88	--	88
Total	78,858	17,428	96,286

[1]Of the total, Japan received 38% and Europe received 50%. The United States received 1,100,000 tons and Argentina received 800,000 tons.

Iron and Steel.—Strong expansion of the iron and steel industry continued, reflecting the priority that the Brazilian Government has given to developing this sector to support industrialization of the country. Production of crude steel grew 10.3% in 1980 to 15.3 million tons compared with the 14.8% growth in 1979. A study made by the Instituto Brasilerio de Siderurgia projects that by 1986 Brazil will produce 25 million tons and that this figure will reach 35 million tons by 1990. These projections are based on an annual GDP growth rate of 6.6%.

During the past decade, Brazil's steel production has increased at an average annual rate of 11%. Per capita steel consumption increased from 61 to 115 kilograms. Steel output from oxygen and electrical furnaces increased from 57% in 1970 to 88% in 1979, thus reducing production from open hearth furnaces. In the same period, steel production from continuous casting increased from 2% to 28% of the total. Employment in the iron and steel industry rose from 81,000 jobs in 1970 to 142,000 jobs in 1979, an annual growth rate of 6.4%.

Since the founding of the Government steel holding company in 1973, Siderúrgica Brasileira S.A., steel output from the majority-owned Government companies has grown to 63% of the country's total steel output.

Since 1973 the Brazilian steel industry has actively pursued the objective of reducing the consumption of imported energy. During 1974-79 the kilograms of fuel oil required to produce 1 metric ton of steel decreased 40% from 142 to 85 kilograms. In 1979, imported energy in the form of coal and fuel oil represented 52% of the energy consumed by the sector. Of the different energy sources, charcoal contributed 13% of the total. In 1979, pig iron made from charcoal was 38% of the total. In the same year, sponge iron output increased 12% to 324,000 tons.

Year	Production	Exports	Imports
1971	127,048	20,881	23,023
1972	139,797	45,438	6,055
1973	179,011	45,987	7,045
1974	227,917	53,256	12,851
1975	256,497	58,650	7,201
1976	311,903	87,254	3,801
1977	371,251	113,576	16,482
1978	409,547	150,365	2,981
1979	r484,209	172,113	1,147
1980	551,749	176,241	2,139

rRevised.

Source: Associação Brasileira dos Produtores de ferroligas, ABRAFE Yearbook 1980, pp. 21, 39.

Ferroalloys.—As shown in metric tons in the table above, Brazil's diverse production and trade in ferroalloys has grown impressively over the past decade.

In 1980, the leading ferroalloy export on a volume basis was ferrochromium followed by ferrosilcomanganese, and ferromanganese (high carbon); whereas on a value basis, the leader was ferrocolumbium followed by ferrochromium and ferrosilicomanganese. Exports were 32% of total ferroalloy output. The value of exports has grown from $68 million in 1976 to $189 million in 1980.

In its 1981 annual report, the Associação Brasileiro dos Produtores de Ferro-Ligas (ABRAFE) reported that 21 companies were active as ferroalloy producers, of which 10 companies were engaged in expansion programs—notably in ferrocolumbium, ferrosilicon, ferrosilicomanganese, and silicon metal.

Outstanding progress was made in 1980 in the output of silicon-base alloys as a result of expansion programs involving the installation of five new electric furnaces. During 1980, domestic consumption of ferroalloys increased 15% to 327,116 tons, of which 82% was consumed by steel plants and 18% by foundries.

Manganese.—Brazil is the leading producer of manganese ore in Latin America and a significant world exporter of beneficiated ore and pellets. As of yearend 1979, DNPM reported a 12% increase in measured reserves of manganese ore to 55.5 million tons with a metallic content of 20 million tons. Total ore reserves were reported at 202 million tons.

According to projections by DNPM, output of beneficiated ore is expected to grow gradually to 2.7 million tons by 1989. However, as Brazil expands its steel industry at a rapid rate, the amount of surplus available for export is expected to decrease from 1,200,000 tons in 1980 to 275,000 tons in 1989.

Industria e Comercio de Minerios S.A., Brazil's largest producer, shipped 1,230,200 tons of manganese ore, including pellets, in 1980 from its Serra do Navio operations in Amapá Territory. Shipments from Porto de Santana went to Europe, 793,000 tons; Japan, 138,000 tons; North America, 73,000 tons, and to South America other than Brazil, 22,000 tons.

Urucum Mineração S.A., 33% owned by CVRD, produced 112,800 tons of manganese ore in the Urucum area of Mato Grosso State near Corumbá. Manganese ore sales amounted to 67,700 tons, of which 38,700 tons were exported and 29,000 tons were

sold in the domestic market.

It is estimated that the Carajás Mineral Province contains 60 million tons of manganese ore with an average grade of 43% manganese in the deposits of Azul, Buritirama, and Sereno. Future development of the manganese would make use of the power, rail, and port infrastructure constructed for the priority iron ore operations. Manganese mining is proposed at a level of 150,000 tons per year.

Tin.—Mostly as a result of discoveries in the Carajás Mineral Province and the increase in reserves at Porto Velho, Rondonia Territory, DNPM reported a 30% increase in the country's measured reserves of tin as detailed below in thousand metric tons:

State or territory	Municipality	Measured reserves[1]	Tin content	1979 production
Rondonia	Porto Velho	44,066	26,440	7,522
Pará	São Felix do Xingú	9,815	6,833	1,306
Mato Grosso	Aripuanã	8,966	4,752	1,366
Amazonas	Novo Aripuanã	3,918	2,062	751
Goiás	Monte Alegre	2,146	1,288	521
Others	--	24,297	13,499	435
Total		93,208	54,874	11,901

[1]Concentrate of cassiterite.

In 1979, the Rondonia tin district accounted for 63% of national output. The principal tin mining operator was a holding company, Paranapanema S.A. Mineração, Industria e Construção operating through a subsidiary, Mineração Taboca S.A. In 1979, Paranapanema produced cassiterite concentrate with a tin content of 2,013 tons. Next in importance were Mineração Brumadinho S.A., Mineração Brasiliense S.A., and Mineração e Prospeccoes Minerais S.A. (BRASCAN Group).

Although output of tin concentrate has been increasing, it has not been adequate to meet the demand of Brazil's smelters. In 1979, Brazil imported 7,542 tons of cassiterite valued at $55 million from Bolivia (74%) and Singapore (26%).

According to DNPM projections, Brazil will become self-sufficient in tin concentrate in 1983 when 15,500 tons will be produced. In 1980, Brazil had an estimated surplus of 5,050 tons of tin metal for export. This tin surplus was projected to increase to 12,960 tons in 1989 when total output by the smelters will be 25,800 tons.

Titanium.—Production of concentrate of ilmenite and rutile is not adequate to meet domestic demand. The sole producer was Nuclebras de Monazita (NUCLEMON) that produced concentrate from ilmeno-monazitic sands. Output has rebounded since 1975 when NUCLEMON assumed control of operations from the Comissao Nacional de Energia Nuclear.

Output of titanium pigment has grown steadily since operations were initiated in 1970. The only producer, Titanio do Brasil (TIBRAS), was expanding capacity from 22,000 to 50,000 tons per year of titanium dioxide to be available during the first half of 1982.

Full capacity would be reached in 1983. TIBRAS had preliminary plans to expand capacity to 70,000 tons per year. DNPM estimated that Brazil's domestic demand in 1980 was 56,000 tons requiring imports of 28,000 tons valued at $34 million. Demand was projected to grow to 88,000 tons by 1989 when imports would increase to 38,000 tons.

Brazil had three producers of ferrotitanium alloy: Electrometalur S.A., Indústria e Comércio in Minas Gerais, Produtos Metalúrgicas S.A. in São Paulo, and Termoligas Metalúrgicas S.A. in Bahia State. Brazilian production during 1967-79 increased almost 350% at an average rate of 16% per year.

Zinc.—While mine output of zinc concentrate and production of primary zinc has been increasing, Brazil remained dependent on foreign sources to meet 23% of domestic demand that in 1980 was about 137,000 tons. In 1979, Brazil's rising trend in imports of refined zinc was reversed and declined 9%. In that year imports of refined zinc amounted to $41 million and came mostly from Mexico (33%), Canada (31%), and Peru (28%).

Output of beneficiated ore increased markedly in 1979, by 80% to 375,900 tons. Utilizing integrated operations at Vazante, Minas Gerais, involving mine, beneficiation, and metallurgical plants, refined zinc was produced by Companhia Industrial

e Mercantil Inga S.A. and Companhia Mineira de Metais S.A. In 1980, Companhia Paraibuna de Metais initiated its metallurgical operations and was expected to produce 21,000 tons of refined zinc. The Praibuna plant processed a small amount of concentrate from Mineração BOQUIRA/COBRAC, a lead producer, and the balance of concentrate was imported.

On the basis of expansion plans by the three refined zinc producers, Brazil was expected to gradually decrease imports of refined zinc and achieve a surplus of 7,000 tons in 1985, at which time total output of primary and secondary zinc would be 187,000 tons.

NONMETALS

As of yearend 1979, DNPM reported substantial increases in the measured reserves of potassic minerals, 523%; diamond, 70%; mica, 67%; natural graphite, 62%; phosphate rock, 53%; leucite, 42%; agalmatolite, 32%; rock salt, 18%; talc, 16%; and magnesite, 15%.

Barite.—Brazil became self-sufficient in barite (barium sulfate) and since that time increasing output has exceeded domestic demand. The surplus available for export in 1980 was estimated at 24,000 tons, while internal demand was estimated at 72,000 tons. Substantial exports of barite were initiated in 1978 to Trinidad and Tobago (82%) and Venezuela (18%).

Brazil's barite reserves are located mostly in Araxá, Minas Gerais, and Camamu and Ibitiara in Bahia, but production has come chiefly from the latter State.

Cement.—Brazil is the largest producer of cement in Latin America and ranks in ninth place worldwide after Spain. Capacity in 1980 was 27 million tons from 56 plants dispersed among the major population centers.

The major cement producer, S.A. Indústrias Votorantim, accounted for 33% of national output. The Votorantim Group operated through 15 cement companies located in 12 States controlling 19 of the 56 plants. As an extensive holding company and Brazil's second largest entity in the minerals sector after CVRD, Votorantim was also an important producer of aluminum through Companhia Brasilera de Alumínio, of nickel through Companhia Niquel Tocantins, and of zinc through Cia Mineira de Metais.

At yearend 1980, Brazil's Votorantim Group began operating Brazil's first underground limestone mine at Santa Helena, State of São Paulo, the site of Latin America's largest cement plant. The $70 million project was completed from studies and with technical assistance of Outokumpu Oy of Finland. The open pit mining in the area has become uneconomical because of the cost of removing overburden.

The second largest cement producer, Grupo João Santos, operated seven plants and accounted for 11% of Brazil's total output. All plants have expansion plans which, together with five new plants programed, would give the João Santos Group a capacity of 7.5 million tons of cement per year by 1985.

Diamond.—In Latin America, Brazil is the second most important producer of natural diamond after Venezuela.

Brazil's total apparent consumption of diamond has grown rapidly from 480,000 carats in 1970 to 3.4 million carats in 1979 at the rate of 22% per year. To meet growing demand for diamond by Brazil's rapid industrialization, imports have risen from 47% to 84% of domestic demand. In 1979, Brazil's demand was comprised of synthetic diamond, 45%; industrial diamond, 25%; and gem-quality diamond, 30%.

The major part of Brazil's production came from garimpeiros, which made it difficult for DNPM to collect precise data. DNPM's conservative estimate is that garimpeiros produce 120,000 carats per year only in the State of Mato Grosso. In 1979, Mineração Tejucana S.A. produced 64,860 carats in the region of Rio Jequitinhonha. Operators in Brazil's diamond industry consider the country's true output to be closer to 800,000 carats per year. Brazil's output consists of 50% industrial-grade and 50% gem-quality diamond.

St. Joe Minerals Corp. reported that it was investigating two promising alluvial diamond properties. At the Alto Coite project, detailed bulk sampling was in progress, to be followed by a feasibility study for a dredging operation. The potentially much larger Araguaia project was in an earlier state of investigation. Discussions were proceeding with potential Brazilian partners for development of these projects should they prove economically viable.

Graphite (Natural).—After Mexico, Brazil ranked second in Latin America as a producer of natural graphite. Brazil's output has increased sharply since 1970 when only 2,500 tons were produced. The main area of commercial importance is Itapecerica in Minas Gerais, where it is estimated that 15 million tons of flake graphite ore occur. Companhia Nacional de Grafite Ltda. is a major producer in Itapecerica, mining

by open pit methods. The company also operates a processing facility that produces flake graphite concentrate that ranges from 60% to 99% carbon, which will be expanded for the widening export market. Chemical beneficiation techniques are employed to produce the grades with the highest carbon content.

Fertilizer Materials.—Brazil has been very successful in closing the gap between demand for phosphatic fertilizers and domestic output. In 1974 Brazil was 85% dependent on imports, whereas in 1980 it was only 40% dependent. In 1980, when domestic demand was 1.57 million tons of phosphatic fertilizers in P_2O_5 content, imports cost $98 million, while in 1979 imports cost $373 million. This improvement resulted from an almost 60% increase in production of phosphate rock in 1980.

According to DNPM projections, the phosphate deficit is expected to decrease markedly until 1985 when imports of 270,000 tons of P_2O_5 will still be required, but then increase again as growing demand outstrips installed capacity.[8]

Local and imported phosphate rock was utilized by Brazil to produce phosphoric acid, 25%; fertilizers, 70%; and other purposes, 5%. Table 7 shows the existing and programed operations for producing phosphate rock concentrate in four States of Brazil. In 1980, Fertilizantes Fosfatados S.A. (FOSFERTIL) was the major producer of phosphate rock from open pit mines in Tapira and Patos de Minas in Minas Gerais. Output was 1,285,000 tons of concentrate, including the merged operations of Mineração Vale do Paranaiba S.A. (VALEP).

CPRM reported a phosphate discovery along the coast of the State of Paraiba between João Pessoa and Rio Tinto. Reserves were estimated at 100 million tons grading 22% P_2O_5.

Table 7.—Brazil: Phosphate projects

(Thousand metric tons)

Company and ownership	Location	Measured reserves	Capacity of P_2O_5 concentrate	Content of P_2O_5	Start-up date
Araxá S.A. Fertilizantes e Produtos Quimicos (ARAFERTIL)[1]	Araxá, Minas Gerais.	273,000	600	210	1977
Goiás Fertilizantes S.A. (GOIASFERTIL)	Catalão, Goiás.	147,000	620	223	1981
Fosfatos de Goiás S.A. (FOSFAGO)	do	80,000	500	190	1979
Mineração Vale do Paranaiba S.A. (VALEP)[2]	Tapira	318,000	900	330	1979
Serrana S.A. de Mineração Santista Group and Bunge y Born Ltda. S.A.	Ipanema, São Paulo.	60,000	330	125	NA
Do	Jacupiranga, São Paulo.	100,000	350	123	1980
Fertilizantes Fosfatados S.A. (FOSFERTIL)[3]	Patos de Minas, Minas Gerais.	256,000	150	39	1980
Industrias Lucksinger Madorin S.A	Anitápolis, Santa Catarina	320,000	600	220	1983
Total		1,554,000	4,050	1,460	

NA Not available.
[1]Owned 40% by Serrana S.A. de Mineração, 40% by the Itau group, and 20% by FIBASE.
[2]VALEP, a subsidiary of CVRD, was merged into FOSFERTIL in 1980.
[3]Merged company is held 34.1% by CVRD; balance by PETROBRAS and BNDE.

Potassium.—Brazil's demand for potassic fertilizers continued to increase up to the level of 1.3 million tons of K_2O in 1980 and was met entirely by imports valued at $152 million. The large increase in potash reserves announced by DNPM amounts to 12.5 billion tons of mineral and is located primarily at Carmópolis in Sergipe State.

The Taquari-Vassouras potassium project in Sergipe was under construction by PETROBRAS Mineração S.A. (PETROMISA), a subsidiary of PETROBRAS. Startup was set for 1983 with a capacity of 500,000 tons of potassium chloride per year by 1989. This would satisfy only a fraction of demand, which was projected to grow to more than 3 million tons of K_2O in 1989.

Sulfur.—Although output of sulfur has increased greatly since 1974, domestic sources account for only 15% of Brazil's growing demand which in 1980 amounted to 841,000 tons. The small domestic output came from Irati oil shale processed at São Mateus do Sul and mostly PETROBRAS refinery operations. Brazil's demand was projected by DNPM to grow to 1.4 million tons of sulfur in 1989, when the country's dependency on imports would decrease to

70%. Sulfur imports in 1979 were valued at $56 million.

PETROMISA completed evaluation of sulfur reserves of 3 million tons at Castanhal, Sergipe. The project is the first for the production of sulfur in Brazil from domestic raw materials.

MINERAL FUELS

In 1980 the Ministry of Mines and Energy issued its annual National Energy Balance prepared by the Comité do Balanco Energetico Nacional. According to this updated study of Brazil's energy situation, in 1979 the country's energy consumption of petroleum, natural gas, and coal was 45% of the total. Considering Brazil's dependency on oil and coal imports for the steel industry, this meant a 37% dependency on external energy sources.

The report offers a national energy model and provides energy supply-demand projections until 1985. The model is based not only on increased domestic oil output from 171,100 barrels per day in 1979 to 500,000 barrels per day in 1985, but also on the development of alternate energy sources and opportunities for conservation.

The report notes that only 12%, of Brazil's estimated hydraulic power potential of 213,000 megawatts is currently utilized, and gives the following projections for installed electric generating capacity in megawatts.

Source	1980	Percent share	1985	Percent share
Hydro	27,263	86.0	43,485	88.8
Thermal	4,377	14.0	4,851	9.9
Nuclear[1]	--	0	626	1.3
Total	31,640	100.0	48,962	100.0

[1]Initial nuclear capacity scheduled for 1981.

Coal.—Brazil in 1980 replaced Colombia as the leading coal producer in Latin America. Despite this success in increasing production, Brazil remained dependent on imports to meet the steel industry's demand for metallurgical coal. Of 5.1 million tons of such coal consumed in 1979, 3.9 million tons was imported. The value of coal imports that year was $314 million, and coke imports cost $41 million. While Brazil's consumption of a metallurgical coal grew from 2.4 million tons in 1969 to 5.1 million tons in 1979, consumption of local charcoal grew from 1.9 to 4.7 million tons.

Steam coal output has doubled since 1974, with domestic supply exceeding demand. Since 1974 use of steam coal by the steel, cement, and paper industries has grown in addition to the traditional use by thermal electrical plants. According to DNPM projections, supply and demand for steam coal will be in balance in 1982 and remain in balance until 1985 when demand for steam coal will grow to 24.6 million tons.[9]

DNPM reported a 74% increase in measured reserves of coal to 1.8 billion tons mostly in the southern States of Santa Catarina and Rio Grande do Sul. The increases occurred chiefly in Lauro Muller and Criciuma in Santa Catarina; and Bagé, Triunfo, and Cachoeira do Sul in Rio Grande do Sul.

In 1980, DNPM published the second edition of its new publication "Informativo Anual da Industria Carbonifera" with data on coal reserves and production of individual coal companies and their operating mines in 1980. The report covers 11 companies in Santa Catarina, 3 in Rio Grande do Sul, and 2 in Parana. Personnel employed in the coal industry totaled 11,700 in 1980.

Natural Gas.—The consumption of natural gas in 1979 accounted for only 0.4% of the country's consumption of primary energy compared with the 40.7% share for petroleum and the 28.3% share for hydropower. Production of natural gas increased 16% in 1980 to record levels. Onshore fields produced 55%, and offshore fields produced 45% of total gas output. Only 21% was not associated with crude oil production.

In the upper Amazon region, substantial gas deposits were found in the Juruá area and positive results were expected in other areas with similar geological features. Gas was also discovered onshore at Miranga, Bahia. Off the coast of Sergipe, a deep well in the Robalo Field produced gas. Brazil's reserves of natural gas have almost doubled since 1975. At yearend, reserves increased to 52.54 billion cubic meters (1.86 trillion cubic feet), a 17% change compared with 1979.

Petroleum.—As a result of intensified exploration and development activities, PETROBRAS increased Brazil's crude oil output by almost 10%. Output increased from an average of 171,100 barrels per day in 1979 to 182,000 barrels per day in 1980. Table 8 provides a breakdown on the producing areas in 1980.

During 1980, PETROBRAS gave priority to its exploration activities which accounted for 71% of its investment program. The intensity of exploration was indicated by the fact that 88 drilling rigs were used during the year, 79 by PETROBRAS and 9 by risk contract operators. Oil reserves increased 6% to 212.8 million cubic meters or 1.34 billion barrels.

Table 8.—Brazil: Crude oil production by PETROBRAS

(Thousand 42-gallon barrels)

Area	1980 production	Share (percent)	
		1979	1980
Bahia	28,958	51.5	43.6
Sergipe	17,014	27.3	25.6
Rio de Janeiro	10,460	9.7	15.7
Rio Grande do Norte	4,894	6.2	7.4
Espírito Santo	2,848	3.5	4.3
Alagoas	1,183	1.8	1.8
Ceará	1,076	--	1.6
Total	66,433	100.0	100.0
Onshore	39,098	65.6	58.9
Offshore	27,365	34.4	41.2

Source: Annual Report of PETROBRAS, 1980.

By yearend, PETROBRAS had signed 80 risk contracts relating to the first four rounds of bidding; the fifth round was being negotiated. The five rounds cover half of the area targeted for such bids, which covers 83% of Brazil's sedimentary basins. In accordance with the Government's policy to accelerate the evaluation of the country's oil potential, to increase the interest of foreign oil companies, and to stimulate the participation of domestic companies in exploration, certain changes were made in the risk contract conditions.

During the year, the average price of petroleum products increased 113%. The price of gasoline increased 126% (an average of $3.10 per gallon for the year) while the price of fuel oil increased almost 400% as a result of the elimination of the Government subsidy and with a view to making its substitution by coal viable and to rationalizing its consumption. The increase in the price of diesel oil was held to only 67% because of its essential use in agriculture and transport.

Gasoline for automobilies, excluding those using fuel alcohol, accounted for 17% of the total consumption of petroleum fuel, a decrease of 15% from 1979 despite the increased number of cars on the road. About 20% of the demand for petroleum fuel was derived from domestic sources. Domestic crude production provided 80% and fuel alcohol provided 20% of the total.

Alcohol Fuel Program.—According to projections in the 1981 National Energy Balance, use of alcohol fuel is to grow from 2.4% of total primary energy consumed in 1980 to 4.1% in 1985. Brazil continued to make progress towards its goal of a 20% mixture of anhydrous alcohol with gasoline. In 1976, 86 liters of gasoline were used for 1 liter of anhydrous alcohol, this ratio fell to 22 liters in 1977, to 7 liters in 1979, and to 5 liters in 1980. Use of hydrated alcohol was initiated in 1978. By 1985, use of hydrated alcohol was projected to be double the use of anhydrous alcohol.

In 1980 alcohol production was 3.4 billion liters. Brazil's alcohol program aims at an annual production capacity of 10.7 billion liters by 1985.

Shale Oil.—Synthetic oil from shale oil deposits in southern Brazil was scheduled to become available in 1985. The prototype unit for processing oil shale at Irati operated practically without interruption in 1980, producing 19,300 thousand cubic meters of oil and 1,833 tons of sulfur. In the Irati formation, detailed studies were made in the Papanduva/Tres Barras area of Santa Catarina and exploratory investigations were made in the Ivai/São Jeronimo area of Paraná.

During 1980, engineering designs were completed for the São Mateus industrial shale oil plant in Paraná State. Designs included mineral treatment, retorting, gas treatment, transfer, and storage. The conceptual plan for the hydrotreatment of shale oil by PETROBRAS' Research and Development Center was also completed.

Uranium-Nuclear Energy.—Brazil has the largest discovered uranium reserves in Latin America and ranks fifth worldwide. There was no change in the reserves of 215,300 tons of yellow cake reported in 1979. In late 1981 or early 1982, the uranium mine at Poços de Cladas, Minas Gerais, was scheduled to begin production at the rate of 2,500 tons of ore per day.

Angra I, Brazil's first commercial nuclear reactor, was scheduled to begin operations in September 1981. The 626-megawatt pressurized water reactor is located in the State of Rio de Janeiro. Work continued on the 1,245-megawatt Angra II unit scheduled for completion in 1987.

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[1]Supervisory physical scientist, Branch of Foreign Data.
[2]Where necessary, values have been converted from Brazilian new cruzeiros (NCr$) to U.S. dollars at the average rate of NCr$52.61 = US$1.00 in 1980.
[3]Departmento Nacional da Produção Mineral. Anuario Mineral Brasileiro-1980, Annual report covers 1979 data.
[4]———. Balanço Mineral Brasileiro. V. I Minerais Metalicos, v. II Minerais Não Metalicos, 1980 Brasilia.
[5]Work cited in footnote 3, p. 19.
[6]Work cited in footnote 4, v. I, p. 38.
[7]Work cited in footnote 4, v. I, pp. 8, 94.
[8]Work cited in footnote 4, v. II, p. 134.
[9]Work cited in footnote 4, v. II, p. 79.

The Mineral Industry of Bulgaria

By Tatiana Karpinsky[1]

Performance of the Bulgarian economy in 1980 showed decreased growth rates in the major economic sectors. According to Bulgarian sources, industrial production and national income increased respectively, 4.1% and 5.7%, well below the initially planned figures of 6.3% and 7.2%.[2]

In 1980, however, the original planned target of 7.2% was revised to 5.7%. The national income generated in 1980 exceeded leva (L) 20 billion.[3]

In 1980, industry accounted for about 58% to 60% of the national income. Capital investments increased from $7.3 billion in 1979 to $8.23 billion in 1980. More than 63% of capital investments was spent for renovation and expansion of existing production facilities in 1980. Labor productivity increased 2.6% and accounted for about 70% of the increase in industrial production.

Major projects put into operation in 1980 included the third turbine of the Maritsa-Istok 3 thermoelectric powerplant; the third 440-megawatt reactor of the Kozloduy nuclear powerplant; the benzine production facility at the petrochemical combine in Burgas; the plant for steel wire and cables in Roman; the first expansion of the U.S.S.R.-Bulgaria gas pipeline; and the first and second lines at the V. Kolarov State cement plant in Temelkovo. In 1979, the number of industrial workers and employees in state enterprises totaled 1,243,768. The number of workers and employees in state mineral and energy enterprises by branch follow:

Branch	Workers and employees (thousands)
Fuel industry	52.0
Ferrous metallurgy (including ore mining)	33.2
Production of electricity and steam and heat power	23.8

Reportedly, the seventh 5-year plan (1976-80) was not fulfilled in all sectors. During 1976-80, the national income of the country increased 40% (planned 48% to 52%). The gross industrial production increased 35% (planned 55% to 60%) and machine-building increased 56.2% (planned about 100%). Cargo transported during the seventh 5-year plan increased by 32% (planned 40%). During the 1976-80 5-year plan, Bulgaria's foreign trade increased 100% (planned 60% to 65%).

Government Policies and Programs.—The targets set for the eighth 5-year plan (1981-85) appear to be scaled down from those of the seventh 5-year plan (1976-80). According to the eighth 5-year plan (1981-85), approved by the 12th National Party Congress, national income is to increase by 25% to 30%, gross industrial output by 30% to 35%, and labor productivity by 36% to 38%. The amount of capital investment is to increase to about L38 billion during the eighth 5-year period. A large part of capital investment is planned for renovation and modernization of existing plants. Heavy

industry is confirmed as the foundation of the economy but more emphasis is to be put on the consumer sector during the 1980-85 period.

In the energy and mineral sectors more emphasis is to be given to increase utilization of local resources and materials. Special stress is to be placed on the production of special steels. The plan also points to the need for increased local production of nonferrous metals, particularly copper. The relative share of electric energy from atomic power is expected to increase from 20% in 1980 to 26% by 1985.

Production of lignite, the main indigenous fuel, is to be increased mainly by developing the important Maritsa-Istok lignite and power generating complex. The exploration of coal in the Dobrudja coal basin is to receive particular attention. Foreign trade is planned to increase 40%, which would be a slowing of the pace set during the seventh 5-year plan (1976-80), when it increased 100%. On improving the management of the economy, the New Economic Mechanism must be fully implemented throughout the entire economy, which is an attempt to partially decentralize the economic planning.

In 1980, Bulgaria created an agency, the Council for Raw Materials and Energy Problems, attached directly to the Council of Ministers. Bulgaria also established a Mineral Bank, the purpose of which is to facilitate receipt of foreign credits for exploitation of Bulgaria's energy and raw materials resources. The bank has vast powers to enter into business arrangements with foreign creditors. Bulgaria's main interest in trade with the west is the import of technology including technology for development of energy and mineral resources including coal.

The national income in the country is to increase 5.1% in 1981 and 5.0% in 1982. Labor productivity is to rise 4.8% in each year. Industrial output is to increase 5.6% in 1981 and 6.0% in 1982. The production of electric power and heating supply is to increase 7.2% in 1981 and 7.4% in 1982 (through the development of atomic energy and thermoelectric plants, based on the local coal supply). Coal mining is expected to develop at an accelerated rate. The plan ensures an increase in the volume of production of ferrous metallurgy; 10% in 1981 and an additional 5.4% in 1982. The production of the chemical industry is to increase 11% in 1981 and 9.5% in 1982. A rapid growth is ensured in the production of ammonia and nitric fertilizers. The volume of transported cargo is to increase 3.6% in 1981 and 3.7% in 1982.[4]

The relative share of machine-building, chemical, metallurgy, and energy in industrial development is planned to increase from 53.2% in 1980 and to 55.2% in 1982.

PRODUCTION

In 1980, the value of industrial output reached L28,578 million, exceeding the 1979 level by L1,130 million. In 1980, industrial production by basic ministries increased over that of 1979 as follows:

Ministry of Power Supply	9.6
Ministry of Chemical Industry	9.7
Ministry of Machine Building	4.5
Ministry of Metallurgy and Mineral Resources	2.4
Ministry of Construction and Construction Materials	3.3

In 1980, the fuel industry fulfilled its plan, 105.6%; the chemical industry, 111%; and machine-building and metal processing industries, 106.3%. In comparison with 1979, the production output increased in coal, steel, nitrogen fertilizers, and the power industries. Ferrous metallurgy also realized slightly higher results in the production of pig iron and rolled steel products. In 1980, zinc production increased slightly in spite of the decline in the metal content of the ore. Production of cement, calcinated soda, and phosphatic fertilizers was lower than in 1979.

In 1980, 34.3 billion kilowatt-hours (kWh) of electric energy was produced or 2.4 billion kWh more than in 1979. Hydroelectric powerplants generated approximately 4.5 billion kWh of electric energy or about 13% of the country's annual output. The Kosloduy nuclear powerplant generated about 7 billion kWh or 20% of the country's annual output. In 1980, the total capacity of the Kozloduy nuclear powerplant was 1,320 megawatts. The share of electric energy produced by nuclear plants is expected to be 30% in 1985 and 50% at the end of the century.[5] Electric energy consumption reached 39 billion kWh in 1980 or 10 billion kWh more than in 1975.

Reportedly, the plan for lowering the use of raw materials and other outlays was fulfilled in 1980. Greater increase in the net industrial output was achieved as a result of savings of raw materials, fuels and energy, and higher labor productivity.

Table 1.—Bulgaria: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Cadmium metal, smelter[e]	220	200	210	210	210
Copper:					
Mine output, metal content	57,000	57,000	58,000	58,000	58,000
Metal, primary and secondary:					
Smelter	60,000	60,000	64,000	64,000	64,000
Refined	[r]58,000	[r]58,000	62,000	62,000	62,000
Iron and steel:					
Iron ore:					
Gross weight thousand tons	2,316	2,270	2,452	2,103	2,100
Fe content do	748	707	762	651	650
Iron concentrates do	1,068	1,055	1,080	960	1,000
Metal:					
Pig iron do	1,558	1,614	1,493	1,450	1,500
Ferroalloys, electric-furnace, all types do	55	50	46	45	45
Crude steel do	2,460	2,589	2,470	2,482	[3]2,566
Semimanufactures, rolled do	2,756	2,931	3,050	3,128	3,215
Lead:					
Mine output, metal content	110,000	117,000	117,000	116,000	116,000
Metal, smelter, primary and secondary	112,000	120,000	120,000	119,000	119,000
Manganese ore:					
Gross weight	40,000	40,000	40,000	42,000	40,000
Mn content	11,200	11,400	11,000	12,300	11,000
Molybdenum, mine output, metal content	140	150	150	150	150
Silver, mine output, metal content[e] thousand troy ounces	900	840	900	920	930
Zinc:					
Mine output, metal content	85,500	87,000	88,000	85,000	87,000
Metal, smelter, primary and secondary	92,500	90,000	91,000	89,000	90,000
NONMETALS					
Asbestos	300	500	700	600	700
Cement, hydraulic thousand tons	4,362	4,665	5,149	5,401	[3]5,359
Clays: Kaolin	194,000	194,000	199,000	202,000	204,000
Gypsum and anhydrite:					
Crude	232	295	340	309	300
Calcined	40	57	82	80	85
Lime: Quicklime thousand tons	1,599	1,725	1,782	1,868	1,900
Nitrogen: N content of ammonia	920,402	995,015	959,710	950,907	960,000
Pyrite, gross weight[e]	636,000	693,000	705,000	715,000	680,000
Salt, all types	75,000	87,000	87,000	86,000	87,000
Sodium compounds, n.e.s.:					
Caustic soda thousand tons	90	100	106	115	[3]168
Sodium carbonate, calcined do	1,045	1,218	1,294	1,498	[3]1,479
Sulfur:					
S content of pyrite	280,000	305,000	310,000	315,000	300,000
Byproduct, all sources	60,000	65,000	70,000	75,000	70,000
Total	340,000	370,000	380,000	390,000	370,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, marketable:					
Anthracite thousand tons	117	103	102	104	126
Bituminous do	196	185	171	170	190
Brown do	5,850	5,748	5,797	5,855	6,521
Lignite do	19,334	19,139	19,733	22,100	24,661
Total do	25,497	25,175	25,803	28,229	[3]31,498
Coke do	1,408	1,446	1,411	1,351	1,300
Natural gas, marketed million cubic feet	1,314	365	1,140	4,820	4,000
Petroleum:					
Crude:					
As reported thousand tons	117	129	180	[e]180	180
Converted thousand 42-gallon barrels	854	942	1,314	[e]1,314	1,314
Refinery products:					
Gasoline do	14,280	14,450	14,620	[e]14,700	14,700
Kerosine do	1,317	1,472	1,550	[e]1,600	1,600
Distillate fuel oil do	22,753	23,872	24,618	[e]24,700	24,700
Residual fuel oil do	33,899	35,298	36,630	[e]36,800	36,800
Lubricants do	595	700	770	[e]750	750
Liquefied petroleum gas do	545	650	754	[e]750	750
Asphalt including natural do	2,385	2,975	3,636	[e]3,700	3,700
Total do	75,774	79,417	82,578	83,000	83,000

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Sept. 30, 1981.

[2]In addition to the commodities listed, bismuth, chromite, gold, palladium, platinum, tellurium, uranium, barite, fluorspar, magnesite, and a variety of crude construction materials (common clays, sand and gravel, dimension stone, and crushed stone) are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

TRADE

In 1980, Bulgaria's foreign trade turnover (exports plus imports) increased 14.1% compared with that of 1979.[6]

The value of exports was L8,918 million, an increase of 16.3% and the value of imports was L8,227 million, an increase of 11.7%.

In 1980, imports of machinery and equipment accounted for about 36% of the total value of Bulgaria's imports; fuels, minerals, and metals accounted for about 43%; chemical products 6%; and building materials less than 1%.

Exports of machinery and equipment comprised about 45% of the value of total exports in 1980; fuels, minerals, and metals about 15%; chemical products 4%; and building materials about 2%.

In 1980, imports of fuels, minerals, and metals increased 16% over that of 1979, these increases were as follows: Bituminous coal, 6.8%; pig iron, 16%; iron ore, 5.6%; coke, 24%; steel, 1.6%; and superphosphate, 22%. In 1980, exports of calcinated soda decreased 1.5% and exports of nitrogenous fertilizer decreased 6%, compared with those of 1979. Trade with the U.S.S.R. accounted for 58.6% of Bulgaria's total foreign trade in 1980.

The U.S.S.R and Bulgaria have signed an agreement on trade for the 1981-85 period and for 1981. The value of trade between the U.S.S.R. and Bulgaria is to amount to 40 billion rubles in the 1981-85 period. During the 1976-80 period, their mutual trade was 28 billion rubles. The Soviet Union is to supply Bulgaria with mining machinery and equipment, iron ore, ferrous and nonferrous metals, natural gas, crude oil and oil products, coal, and electric energy. Bulgaria is to export to the Soviet Union machinery and equipment, food, and chemicals, including soda ash and other commodities.[7]

In 1980, over 13,000 Bulgarian workers were engaged in the construction of various projects in the U.S.S.R. Bulgaria's assistance in developing the fuel and raw material complexes on Soviet territory ensures the country supplies of extra quantities of iron ore concentrate, asbestos, natural gas, and ferroalloys in the next 10 to 12 years.

Trade between Bulgaria and the Democratic People's Republic of Korea in 1981-85 is to increase 75% compared with the 1976-80 period. Bulgaria is to export machinery and equipment, soda ash, and urea in exchange for machinery and equipment, high-grade steel, and cement.[8] Economic cooperation between Bulgaria and Mexico is also to increase considerably. Bulgaria is to supply Mexico with soda ash, fertilizers, machinery, and equipment for various raw materials.

The Deputy Minister of Bulgaria's foreign trade reported that a long-term trade agreement signed by Bulgaria and the other centrally planned economy countries provides for an average growth of trade in the eighth 5-year plan period (1981-85) equal to 43% at 1980 prices, compared with the achievement in the 1976-80 period.

Table 2.—Bulgaria: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Oxides and hydroxides	--	165	All to Italy.
Metal including alloys:			
Scrap	--	384	West Germany 212; Italy 101; Sweden 61.
Unwrought	4,629	5,066	Japan 2,661; West Germany 991; Yugoslavia 800.
Semimanufactures	--	4	All to Thailand.
Bismuth metal including alloys, all forms	3	23	West Germany 15; United States 8.
Cadmium metal including alloys, all forms	133	65	West Germany 56.
Cobalt oxides and hydroxides	2	--	
Copper:			
Sulfate[3]	5	30	All to Vietnam.
Metal including alloys:			
Scrap	293	836	West Germany 686.
Unwrought	2,368	1,201	West Germany 665; Italy 322.
Semimanufactures	256	398	Morocco 209; Turkey 87.
Iron and steel metal:			
Scrap	[4]167,000	[4]130,000	Italy 90.606; Austria 37,584.
Pig iron	[5]47,500	[5]12,300	Italy 8,000; Jordan 404.
Ferroalloys	[4]24,000	[4]22,000	Poland 5,767; West Germany 3,743.

See footnotes at end of table.

Table 2.—Bulgaria: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Iron and steel metal —Continued			
Steel, primary forms	r514,161	605,343	Italy 228,064; Belgium-Luxembourg 88,230; Yugoslavia 61,293.
Semimanufactures:			
Bars, rods, angles, shapes, sections	[4]133,000	[4]189,000	Egypt 74,497; Poland 23,564; Hungary 21,903.
Universals, plates, sheets	[4]494,000	[4]430,000	Yugoslavia 59,284;[3] East Germany 36,563;[3] Romania 29,573.[3]
Hoop and strip	19,519	12,935	Greece 12,888.
Rails and accessories	r77	390	Tunisia 384.
Wire	[4]38,000	[4]32,000	NA.
Tubes, pipes, fittings	[5]71,000	[5]69,600	Poland 18,560; Italy 4,465.
Castings and forgings, rough	r8,751	11,926	Poland 11,388.
Lead:			
Ore and concentrate	NA	[6]6,000	NA.
Oxides and hydroxides	2,598	2,678	Yugoslavia 1,397; West Germany 510.
Metal including alloys:			
Scrap	--	33	All to Italy.
Unwrought	13,779	10,852	Yugoslavia 6,779; Greece 1,382; Italy 1,202.
Manganese ore and concentrate	8,191	[5]5,600	Mainly to Czechoslovakia.
Molybdenum ore and concentrate	23	54	All to United States.
Nickel metal including alloys:			
Scrap	84	26	All to West Germany.
Unwrought	176	150	West Germany 142.
Semimanufactures	13	([7])	All to Yugoslavia.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$18	$96	All to Switzerland.
Silver:			
Waste and sweepings[8] do	$717	$1,529	Switzerland $777; West Germany $551.
Metals including alloys, unwrought and partly wrought do	$2,368	$4,595	Japan $3,363; West Germany $891.
Tin metal including alloys:			
Scrap	--	4	All to West Germany.
Unwrought	--	1	Do.
Zinc:			
Oxides and peroxides	--	15	All to Japan.
Metal including alloys:			
Scrap	440	29	All to West Germany.
Unwrought	24,737	13,216	Czechoslovakia 5,000; United Kingdom 2,704; Italy 1,851.
Other:			
Ash and residue containing nonferrous metals	81	136	West Germany 88; Italy 25.
Oxides, hydroxides, peroxides	17	24	Netherlands 11; United Kingdom 5.
Metals:			
Metalloids	--	37	West Germany 34.
Base metals including alloys, all forms	142	12	Belgium-Luxembourg 7; Netherlands 5.
NONMETALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	1	--	
Boron materials: Crude natural borates	--	2,660	All to Italy.
Cement[3] thousand tons	395	455	U.S.S.R. 101; Yugoslavia 71; Libya 31.
Clay and clay products:			
Crude clays:			
Fuller's earth and chamotte	2,330	--	
Kaolin	5,056	7,531	Hungary 6,656; Tunisia 650.
Other	7,958	5,942	Greece 5,912.
Clay products:			
Refractory including nonclay brick	2,383	88	Saudi Arabia 69; Italy 19.
Nonrefractory	2,603	2,827	Yugoslavia 1,838; Saudi Arabia 308; Egypt 503.
Diamond:			
Gem, not set or strung value, thousands	$301	$284	All to Yugoslavia.
Industrial do	$211	$2,005	All to Belgium-Luxembourg.
Feldspar and fluorspar	42	--	
Fertilizer materials:			
Crude, nitrogenous[3]	5,669	7,412	U.S.S.R. 2,551; Spain 1,063; Czechoslovakia 684.
Manufactured:			
Nitrogenous[3]	713,889	572,223	India 104,418; Syria 57,612; Greece 39,274.
Potassic	18,413	506	Yugoslavia 466.
Other including mixed	--	79	All to Italy.
Gypsum and plasters	--	24	Do.
Lime	20,978	15,165	All to Hungary.
Pigments, mineral: Processed iron oxides	550	--	
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[5]1,400	[5]2,100	Tunisia 62; Costa Rica 21.
Caustic potash	10	135	Turkey 110.
Soda ash[3] thousand tons	959	1,125	U.S.S.R. 445; Hungary 113; West Germany 85.

See footnotes at end of table.

Table 2.—Bulgaria: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	1,241	1,654	Greece 965; Italy 316; Belgium-Luxembourg 125.
Worked	5	14,370	Pakistan 7,513; West Germany 2,483; Saudi Arabia 1,463.
Gravel and crushed rock	5,545	3,961	All to Hungary.
Quartz and quartzite	42	2	All to Japan.
Sand excluding metal-bearing	5,535	4,443	All to Greece.
Sulfur: Sulfuric acid, oleum[3]	7,237	2,284	Romania 1,885.
Talc, steatite, soapstone	431	--	
Other:			
Crude	8,620	9,249	Hungary 8,668.
Slag, dross, and similar waste, not metal-bearing	--	23	All to Spain.
Halogens	--	4,978	All to Yugoslavia.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	25	7	All to United Kingdom.
Coal and briquets:			
Anthracite and bituminous coal	[5]184,000	[5]13,600	NA.
Lignite including briquets	--	102	All to Italy.
Coke and semicoke	--	39	All to Greece.
Peat including briquets and litter	--	35	All to Italy.
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	549	698	Netherlands 384; West Germany 314.
Kerosine, do.	4	322	Spain 313.
Distillate fuel oil, do.	685	1,519	Turkey 1,299; France 141.
Residual fuel oil, do.	1,513	5,260	Italy 3,447; Yugoslavia 781; Greece 533.
Lubricants, do.	75	199	Yugoslavia 75; Spain 48; Belgium-Luxembourg 33.
Other:			
Liquefied petroleum gas, do.	322	398	Yugoslavia 393.
Mineral jelly and wax, do.	15	23	Italy 16; Yugoslavia 4.
Nonlubricating oils, do.	--	305	All to Spain.
Bitumen and other residues, do.	1	36	All to Yugoslavia.
Unspecified, do.	155	181	All to Poland.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	6,663	3,888	Yugoslavia 1,812; Italy 1,200; France 436.

[r]Revised. NA Not available.

[1]Owing to the lack of official trade data published by Bulgaria, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of Bulgaria.

[2]Unless otherwise specified, data are compiled from official statistics of individual trading partners.

[3]Official trade statistics of Bulgaria.

[4]Quarterly Bulletin of Steel Statistics for Europe, prepared by the United Nations, New York.

[5]Statistical Yearbook of the Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[6]Monthly Bulletin of the International Lead and Zinc Study Group, London, United Kingdom.

[7]Less than 1/2 unit.

[8]May include waste and sweepings of platinum-group metals.

Table 3.—Bulgaria: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite	25	84	All from Hungary.
Oxides and hydroxides	56	154	France 81; Italy 64.
Metal including alloys:			
Unwrought	599	5,025	France 1,496; Hungary 1,180; Austria 1,149; West Germany 1,100.
Semimanufactures	8,742	11,192	West Germany 3,563; Greece 2,453; Austria 1,829; Hungary 1,453.
Antimony metal including alloys, all forms	585	200	All from Yugoslavia.
Chromium:			
Oxides and hydroxides	351	350	All from U.S.S.R.
Metal including alloys, all forms	5	--	
Cobalt:			
Oxides and hydroxides	4	--	
Metal including alloys, all forms	--	1	All from West Germany.
Copper:			
Ore and concentrate	650	985	All from Algeria.
Matte	1,015	--	
Sulfate[3]	7,695	8,677	All from U.S.S.R.

See footnotes at end of table.

Table 3.—Bulgaria: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Copper —Continued			
Metal including alloys:			
Unwrought	405	1,071	All from France.
Semimanufactures	2,862	2,372	West Germany 1,520; Yugoslavia 372; Austria 353.
Iron and steel:			
Ore and concentrate[3] thousand tons	1,645	2,107	All from U.S.S.R.
Metal:			
Scrap do	--	1	All from West Germany.
Pig iron[3] do	408	356	All from U.S.S.R.
Ferroalloys[4] do	14	19	NA.
Steel, primary forms do	[4]401	[4]386	France 71; West Germany 19.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	[4]358	[4]376	U.S.S.R. 79;[3] East Germany 29;[3] Italy 28.
Universals, plates, sheets[3] do	193	253	U.S.S.R. 132; France 42; West Germany 26.
Hoop and strip[3] do	7	6	U.S.S.R. 5.
Rails and accessories do	[4]60	[4]54	Austria 7.
Wire do	[4]31	[4]23	Austria 5; West Germany 3; Italy 2.
Tubes, pipes, fittings do	[5]96	[5]90	West Germany 18; Spain 11; France 6; Japan 6.
Castings and forgings, rough do	[4]24	[4]19	Hungary 6; Poland 1.
Lead ore and concentrate	5,100	23,818	Yugoslavia 6,823; Greece 5,850; Morocco 4,707.
Magnesium metal including alloys, semimanufactures	--	3	All from West Germany.
Manganese:			
Ore and concentrate	[5]72,100	[5]99,900	All from U.S.S.R.
Oxides and hydroxides	302	290	Ireland 200; Greece 70.
Mercury 76-pound flasks	348	([6])	All from Japan.
Molybdenum ore and concentrate	23	50	All from West Germany.
Nickel metal including alloys, semimanufactures	47	175	France 106; West Germany 39; Austria 20.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$255	$1,839	France $995; West Germany $817.
Silver metal including alloys, unwrought and partly wrought do	$3,762	$2,575	Switzerland $2,170; France $234; West Germany $147.
Tin:			
Oxides and hydroxides	4	--	
Metal including alloys:			
Unwrought	602	638	Malaysia 630.[7]
Semimanufactures	--	1	Mainly from West Germany.
Titanium:			
Ore and concentrate	1,820	1,046	All from West Germany.
Oxides and hydroxides	1,746	2,624	Italy 1,379; Spain 1,100.
Tungsten metal including alloys, all forms	3	2	Mainly from Japan.
Zinc:			
Ore and concentrate	30,593	29,253	Belgium-Luxembourg 10,506; Greece 8,210; Ireland 5,271.
Metal including alloys, semimanufactures	1	--	
Zirconium ore and concentrate	760	604	All from West Germany.
Other:			
Ores and concentrates	--	61	Netherlands 41; Italy 20.
Ash and residue containing nonferrous metals	16,248	18,869	All from Yugoslavia.
Oxides, hydroxides, peroxides	82	32	Netherlands 22; West Germany 10.
Metals			
Metalloids	1,613	2,130	Yugoslavia 1,293; France 638.
Alkali, alkaline-earth, rare-earth metals	--	34	France 33.
Base metals including alloys, all forms	211	183	Turkey 170; United States 6; United Kingdom 6.
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	--	40	Italy 21; Netherlands 18.
Artificial corundum	NA	1,696	Yugoslavia 1,035; Hungary 571.
Dust and powder of precious and semiprecious stones value, thousands	--	$158	West Germany $104; Belgium-Luxembourg $54.
Grinding and polishing wheels and stones	602	759	Austria 252; Yugoslavia 239; Italy 128.
Asbestos, crude	2,097	3,333	All from Canada.
Boron materials:			
Crude natural borates	4,425	3,415	All from Turkey.
Oxide and acid	500	200	All from Italy.
Cement thousand tons	[5]315	[5]236	U.S.S.R. 166.
Clays and clay products:			
Crude clays	1,306	1,404	United Kingdom 1,342; Switzerland 31.

See footnotes at end of table.

Table 3.—Bulgaria: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Clays and clay products —Continued			
Products:			
Refractory including nonclay brick	34,197	40,281	U.S.S.R. 20,772; Greece 6,373; Poland 5,040.
Nonrefractory	259	438	Italy 329; Yugoslavia 109.
Diamond:			
Gem, not set or strung value, thousands	$566	$7	All from France.
Industrial do	$183	$4,303	Belgium-Luxembourg $2,524; United Kingdom $961; West Germany $818.
Diatomite and other infusorial earth	70	99	France 96.
Feldspar and fluorspar	142	267	All from West Germany.
Fertilizer materials:			
Crude, phosphatic[3] thousand tons	1,457	1,483	U.S.S.R. 719; Morocco 638.
Manufactured:			
Phosphatic, P_2O_5 content	[5]38,500	[5]39,000	Mainly from U.S.S.R.
Potassic, K_2O content	[5]38,300	[5]59,300	Do.
Other including mixed	--	23	All from West Germany.
Ammonia	1	--	
Lime	5	23	Spain 14; West Germany 9.
Magnesite	251	180	France 111; Yugoslavia 49; Japan 18.
Mica:			
Crude including splittings and waste	[r]115	28	All from West Germany.
Worked including agglomerated splittings	1	12	Spain 10.
Pigments, mineral: Processed iron oxides	1,037	307	West Germany 258; Japan 48.
Precious and semiprecious stones excluding diamond:			
Natural value, thousands	$58	$85	Switzerland $44; West Germany $41.
Synthetic do	$110	$15	Switzerland $11; Austria $4.
Salt and brine	NA	49,800	All from Tunisia.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	241	4,196	Czechoslovakia 3,713; West Germany 250.
Caustic potash	275	560	Belgium-Luxembourg 480; France 80.
Soda ash	7	--	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	95	410	Greece 312; Portugal 98.
Worked	333	80	Italy 67; France 13.
Dolomite	8	--	
Gravel and crushed rock	250	89	Yugoslavia 64; France 25.
Limestone excluding dimension	--	162	All from Italy.
Quartz and quartzite	416	518	All from Sweden.
Sand excluding metal-bearing	--	2,244	All from Netherlands.
Sulfur:			
Elemental:			
Other than colloidal	6,045	3,492	All from Yugoslavia.
Colloidal	--	5	All from France.
Sulfuric acid, oleum	22	84	West Germany 83.
Talc, steatite, soapstone	84	55	West Germany 35; Spain 20.
Other:			
Crude	705	566	Greece 540.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	--	152	France 147.
Slag, dross, similar wastes, not metal-bearing	90	--	
Halogens	--	1	All from France.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	2	All from West Germany.
Carbon black[3]	25,335	25,861	U.S.S.R. 24,837; East Germany 679.
Coal, anthracite and bituminous thousand tons	[5]6,385	[5]6,358	Mainly from U.S.S.R.
Coke and semicoke[3] do	310	345	U.S.S.R. 262; Poland 28; Czechoslovakia 19.
Gas, natural million cubic feet	[e]106,700	[8]141,758	All from U.S.S.R.
Petroleum and refinery products:			
Crude thousand 42-gallon barrels	[5]92,933	[8]95,550	Mainly from U.S.S.R.
Refinery products:			
Gasoline do	79,509	60	Austria 34; Yugoslavia 26.
Kerosine do	9,626	13,152	Hungary 12,044; Greece 922.
Distillate fuel oil do	7,572	9,601	Greece 9,101; Italy 321.
Residual fuel oil do	12,408	2,798	Greece 2,125; Yugoslavia 673.
Lubricants do	24,073	26,313	Greece 8,491; West Germany 3,997; France 3,738; Yugoslavia 3,178.
Other:			
Liquefied petroleum gas do	12	8,770	Italy 8,758.
Mineral jelly and wax do	1,480	543	West Germany 299; Netherlands 212.
Bitumen and other residues do	24,216	18,362	Hungary 18,083; Italy 158.
Bituminous mixtures do	133	--	
Unspecified do	[r]22,590	30,120	All from Poland.

See footnotes at end of table.

Table 3.—Bulgaria: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
MINERAL FUELS AND RELATED MATERIALS — Continued			
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5,932	9,868	U.S.S.R. 9,478; West Germany 343.

[e]Estimated. [r]Revised. NA Not available.

[1]Owing to a lack of official trade data published by Bulgaria, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of Bulgaria.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Official trade statistics of Bulgaria.

[4]Quarterly Bulletin of Steel Statistics for Europe, United Nations, New York.

[5]Statistical Yearbook of the Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[6]Less than 1/2 unit.

[7]Metallgesellschaft Aktiengesellschaft. Metallstatistik, Frankfurt am Main, West Germany.

[8]Yearbook of World Energy Statistics, United Nations, 1981, New York.

COMMODITY REVIEW

METALS

Aluminum.—A plant, producing 30,000 tons of aluminum shapes per year, operated at full capacity at the town of Shumen in 1980. The plant's output almost completely satisfied Bulgaria's demand for aluminum products.[9]

The raw materials for the plant were supplied by the U.S.S.R. and Yugoslavia.

In the near future, production of the metal from a nonbauxite mineral, named bulgarite, is to begin. Bulgarite contains 60% silicon, about 20% alumina, 8% potassium, and some sodium oxide. The country's resources of bulgarite are estimated at 1,000 million tons. Attempts were also made to obtain aluminum from certain types of clay.

Copper.—The Medet open pit, near Pazardzhik, with an output capacity of 8 million tons per year of copper ore, continued to be the main source of copper ore in 1980. The ore was low-grade with an average copper content of 0.34% and molybdenum content of 0.008%. The most abundant copper sulfide mineral was chalcopyrite. Pyrite was also abundant in places.

In 1979, Bulgaria started development of the Assarel copper deposit, which is located near the Medet Mine. The Assarel Mine was considered as one of the major projects of the 1981-85 5-year plan. In 1980, the Elatsite open pit, with a planned annual capacity of 10,000 tons of ore, was another large development. Copper content in the ore is about 0.45%. The Elatsite ore-dressing plant, located near Korlovo, provided approximately 22% of Bulgaria's copper concentrate needs in 1980. A second stage of the plant is expected to be completed in 1982. After completion, the Elatsite plant is to provide all of Bulgaria's needs in copper concentrates.

In addition, the plant is to extract molybdenum and pyrites from the ore. It took 4 years to build a 6.5-kilometer tunnel at the site to enable the Bulgarians to mine the ore high up in the mountains and then transport it down to the ore-dressing plant located below.

Reportedly, the U.S.S.R. was the largest supplier of equipment and machinery for the Elatsite dressing plant. The Federal Republic of Germany, Sweden, and Japan have also supplied equipment for the plant. The Elatsite Mine was designed with Soviet cooperation and L240 million was invested in its development. It is planned to extract up to 87% of the metal content in the ore. In 1980, one of the country's biggest copper ore deposits, the Prokhorovo, was under exploration. Further renovation was underway at the Georgi Damyanov copper plant in 1980. Under an agreement signed in 1979 between Bulgaria and Finland, two Finnish firms, Autokumpu Ahlstvom and Rauma-Repola, were to deliver and install equipment for the Outokumpu flash copper smelter at the Georgi Damyanov copper plant in 1981-82. The planned annual capacity of the plant is 120,000 tons of copper.

Iron and Steel.—Bulgaria's domestic output of iron ore is not large and only partly meets the needs of the Bulgarian industry. The U.S.S.R. has for many years been the main source of iron ore for Bulgaria. Principal iron ore deposits in Bulgaria are located in Kremikovtsi, Krumovo, and Martinovo.

The Krumovo and Martinovo ores contain magnetite and the Kremikovtsi ore contains 70% limonite, 18% to 20% siderite, and 10% to 12% hematite. Iron ore reserves in Bulgaria are estimated at 300 million to 400 million tons with an average iron content of about 30%. Planned production for 1980 was about 1.8 million tons of pig iron, 2.9 million tons of crude steel, and 3.4 million tons of rolled steel products. The output of pig iron, crude steel, and rolled steel products was below the planned targets in 1980. The ferrous metals group held one of the leading positions in foreign trade. In 1980, it accounted for an estimated 4% of Bulgaria's industrial exports and an estimated 10% of total industrial imports. Steel consumption in 1980 was about 3.9 million tons, an increase of about 2% over that of 1979. Two large metallurgical complexes, the Lenin metallurgical complex at Pernik and the Kremikovtsi complex, continued to be under renovation in 1980.

The development program of the Pernik metallurgical complex started in 1972 and is to be completed by 1985. An electric furnace plant, with four 100-ton arc furnaces and a continuous casting plant, was under construction in 1980. The four electric steel furnaces, with a capacity of 1 million tons per year, are expected to be commissioned in 1981. After renovation, the Lenin plant's annual capacity is expected to be 1.5 million tons of steel and about 1 million tons of rolled products. High-quality steel is to make up 80% of the output.

In 1980, the Kremikovtsi iron and steel complex produced more than 80 types of steel and ferrous alloys and more than 1,200 rolled sections. The complex meets about 80% of the national demand in rolled steel. About 30% of the complex's production was exported in 1980. During the 1981-85 period, the Kremikovtsi iron and steel complex is to increase production of pig iron by 20%, steel by 22%, and rolled products by 20%. The increases are to be achieved mainly through improved efficiency.

A metallurgical plant, to be built near the City of Burgas, is to produce 1 million tons of different types of steel per year. During the first stage, which is to be completed by 1985, a rolling mill plant with a planned annual production capacity of 640,000 tons is to be built. Iron ore for the new plant is to come from the U.S.S.R.[10]

In 1985, a small casting shop is to be put into service at the Ikhtiman iron plant to increase the enterprise's annual production to 100,000 tons from its capacity of 62,000 tons in 1980.

Lead and Zinc.—Bulgaria's industry fully met the country's needs for lead and zinc and for over 90% of the consumption of shaped, heavy nonferrous metals and alloys in 1980. Total consumption of zinc was approximately three-fourths of the total zinc production in 1980.

Lead and zinc ore deposits occur in the Rhodopes, Lozen, and Osogovo Mountains in southern Bulgaria. Bulgaria has several mining enterprises for lead and zinc production: Gorubso, Osogovo, Madjarovo, and a few others. The main lead and zinc production is concentrated at the Gorubso Mining Administration which operates the Rudozem, Madan, Ustrem, Erema River, and Lekite beneficiation plants and about 40 mines. Reportedly, in 1980, Gorubso enterprise accounted for about 80% of total lead-zinc production. In 1980, the new Rouen lead-zinc mine at the Osogovo Administration went into operation and in the same year construction of the Osogovo ore concentrator started.

Reportedly, the Bulgarian lead-zinc industry was successful in 1980 regarding utilization of ores, semiproducts, and in the application of a number of new effective technological processes.

NONMETALS

Cement.—The Ministry of Construction and Building Materials approved the plan of the Institute of Kharkov (U.S.S.R.) for the development of the Bulgarian cement industry up to 1990. According to the plan, the production of cement, which was 5.4 million tons in 1980, is expected to increase considerably in the new decade (1980-90). Planned production for cement was 6.6 million tons in 1980. During the coming 5-year plan (1981-85), more funds have been allocated for the construction of a second technological production line at the V. Kolarov State cement plant in Temelkovo with a 600,000-ton capacity, and for a seventh technological line at the V. Pik State cement plant in Vratsa.

Fertilizer Materials.—Bulgaria is self-sufficient in nitrogenous fertilizers and exported 242,000 tons (nutrient content) in 1980. In 1980, Bulgaria had two nitrogen plants under construction at Povelianovo in the Varna district and at Vratsa. Completion of the plants is scheduled for 1981. These plants are to expand the size of Bulgaria's nitrogen industry by an esti-

mated 30% in 1985 compared with the 1980 level. The Stara Zagora nitrogen complex was converted to run on Soviet natural gas in late 1979. In 1980, Bulgaria offered India a guaranteed supply of 1 million tons of fertilizers at 0.2 million tons per year over the next 5 years.[11]

Bulgaria is a large-scale importer of phosphate fertilizers. Imports of phosphatic fertilizers (P_2O_5content) increased from 183,000 tons in 1979 to 223,000 tons in 1980.[12]

Fertilizer plant capacities are planned to be continually enlarged to meet domestic requirements. Expansion in production of the Dmitrovgrad complex was recently reported. According to the plan, capacity of the phosphoric acid plant at the complex is to increase from 110,000 tons per year in 1980 to 140,000 tons per year in 1982 and the new sulfuric acid plant, with a capacity of 180,000 tons per year, is to go onstream by the end of 1982. Other facilities at the complex, which are planned to go into operation in 1982, include the new triple superphosphate plant with a capacity of 160,000 tons per year. In 1980, the total annual capacity of the three existing sulfuric acid plants was 400,000 tons and capacity of the triple superphosphate plant was 150,000 tons. Completion of the facilities for the production of 760,000 tons per year of nitrogen fertilizer at the Dmitrovgrad complex is planned for 1984.

MINERAL FUELS

Estimated production of primary energy derived from fossil fuels and hydroelectric and nuclear generation in Bulgaria was 17.9 million tons of standard coal equivalent (SCE) in 1980 compared with 16.0 million tons of SCE in 1979. In 1980, the estimated share of coal (lignite, brown, and bituminous) in total primary energy production was 89%; the share of crude oil, 1.6%; natural gas, 1.1%; hydroelectric power, 3.3%; and nuclear energy, 5.0%. The total consumption of primary energy increased from 50.7 million tons of SCE in 1979 to an estimated 52.8 million tons of SCE in 1980. In 1980, coal provided an estimated 43.3% of the total consumption, while oil represented 37.5%; hydroelectric energy, 1.1%; nuclear energy, 1.7%; and imports of energy, 0.9%.

Table 4.—Bulgaria: Total primary energy balance for 1979 and 1980

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (bituminous, brown, and lignite) and coke	Crude oil and petroleum products	Natural gas	Hydroelectric power	Nuclear power	Other sources of energy
1979:[r]							
Production	16.0	14.3	.3	.2	.4	.8	--
Imports	34.8	6.7	19.5	8.0	--	--	.6
Exports	.1	--	--	--	--	--	.1
Apparent consumption	50.7	21.0	19.8	8.2	.4	.8	.5
1980:[e]							
Production	17.9	15.9	0.3	0.2	0.6	0.9	--
Imports	35.0	6.9	19.5	8.0	--	--	0.6
Exports	.1	--	--	--	--	--	.1
Apparent consumption	52.8	22.8	19.8	8.2	.6	.9	.5

[e]Estimated. [r]Revised.

[1]One ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are as follows: Hard coal 1.0; brown coal and lignite, 0.5; crude oil, 1.47; natural gas (1,000 cubic meters), 1.33; hydroelectric and nuclear power (1,000 kWh), 0.125.

Coal.—In 1980, coal and lignite production increased over the 1979 level. However, it did not reach the original planned target of 37 million to 38 million tons. Coal production is planned to reach 46 million tons in 1985 and 60 million tons in 1990. Lignite production is planned to be 37.4 million tons in 1985 and brown coal production is planned to be 8.3 million tons. Deep-mined production is to increase from 6.45 million tons in 1980 to 10.64 million tons in 1985. Coal imports amounted to about 6 million tons in 1980.[13]

In 1980, East Maritsa Basin's surface output of lignite accounted for about 60% of the total coal production in Bulgaria and Bobov Dol brown coal basin accounted for 10%. The Bobov Dol Basin produced 40% of total brown coal production in 1980. The plan foresees the development of the Bobov Dol complex, which is to increase brown coal production over the 1979 levels as follows: 1981, 44%; 1983, 56%; and 1985, 61%.[14]

In 1980, Bulgaria continued to undertake efforts to expand bituminous and lignite output in order to ensure the maximum degree of self-sufficiency in national energy consumption. Many mines were under development and renovation with the assistance of the U.S.S.R. Among the mines that came into operation in the 1976-80 period were: Amalgamated Bobov Dol, Troyanovo-South (first stage), and Oranovo (Pirin Basin).

The projected capacity of the Troyanovo-South open pit in the East Maritsa Basin is 26 million tons per year and for the Troyanovo-North Basin it is 19.5 million tons. Zdravets Mine in the West Maritsa Basin is to be the country's largest underground coal mine. It's annual capacity is planned to be 2 million tons per year. A beneficiation plant with 4 million tons of raw coal capacity is to receive coal from other mines as well. The Zdravets Mine is to go into operation in 1985.

Natural Gas.—Natural gas deliveries from the U.S.S.R. are to be increased from 6 billion cubic meters in 1980 to 10 billion cubic meters in 1985. The Soviet Union began exporting natural gas to Bulgaria in 1974 via a pipeline running from the southern Ukraine along the Black Sea coast through Romania to the Varna Devnya area, then west to Pleven, Vratsa, and Sofia.

In 1980, work was continued on the southern branch also terminating at Sofia. The first stage of the Devnya-Burgas-Stara Zagora-Dmitrovgrad-Plovdiv-Sofia southern branch was near completion in 1980. Operation of this line is expected to start in May 1981.

Soviet gas has considerably cut the cost of the Bulgarian production of steel, ammonia, fertilizers, and other commodities. Existing indigenous reserves of gas are limited and insufficient to meet the country's needs. Recently, gas deposits were discovered near Dolni Lucovit, Burdarski, Gevan, and Pisarev.

In 1980, gas and petroleum prospecting with the assistance of the U.S.S.R. continued in the Black Sea on the Bulgarian Shelf.

Petroleum.—The 1980 domestic output of crude oil, compared with estimated oil imports of 11 million to 13 million tons, was relatively unimportant. The U.S.S.R. was Bulgaria's main oil supplier. The prospects for future Soviet oil deliveries are less favorable because Soviet production growth rates have slowed down. In 1980, about 8% of total crude oil imports came from Libya. Domestic oil production came from the small oilfields in the northwest part of the country. Additional fields are thought to be located on the Black Sea Shelf and exploratory drilling is planned to start shortly.

Reportedly, discussions were held with Occidental Petroleum of the United States concerning a plan for joint oil exploration in Bulgaria, both onshore and offshore. The Neftochim petrochemical complex, located about 15 miles outside of Burgas, processed 80% of Bulgaria's crude oil imports into fuels and chemicals. All of the oil used in the complex came from the U.S.S.R. In 1980, about L300 million worth of new facilities were put into operation at the complex. The catalytic cracking complex is due to begin operations by June 1, 1981. Additional quantities of high-octane gasoline, diesel fuel, and raw materials for the chemical industry are expected to be produced at the plant. However, construction of facilities was hampered by the delay in deliveries of imported technological equipment and lack of skilled labor. The benzine unit at this complex was designed for 140,000 tons per year of production capacity.

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[1]Foreign mineral specialist, Branch of Foreign Data.
[2]Rabotnichesko Delo (Labor Review), (Sofia). Jan. 30, 1981, pp. 1-2.
[3]Official exchange rate for the Bulgarian leva (L) for 1980 was L1 = US$1.17.

[4]Rabotnichesko Delo (Labor Review), (Sofia). Dec. 17, 1980, p. 2.
[5]Energetika (Energy), (Sofia). No. 6, 1980, pp. 3-4.
[6]Statisticheski Isvestiya (Statistical News), (Sofia). No. 4, 1980, p. 46.
[7]Foreign Trade (Moscow). No. 4, 1981, p. 16.
[8]Bulgarian Foreign Trade (Sofia). No. 2, 1981, p. 48.
[9]Foreign Trade (Moscow). No. 9, 1980, p. 42.
[10]Bulgarian Foreign Trade (Sofia). No. 1, 1980, p. 48.
[11]Nitrogen (London). No. 126, July-August 1980, p. 6.
[12]Statisticheski Isvestiya (Statistical News), (Sofia). No. 1, 1981, p. 52.
[13]V'Glischa (Coal), (Sofia). No. 6, 1981, p. 198.
[14]V'Glischa (Coal), (Sofia). No. 1, 1980, p. 6.

The Mineral Industry of Burma

By Gordon L. Kinney[1]

Burma's most significant mineral production included lead, zinc, tin, tungsten, barite, jadeite, and petroleum. By far the most valuable product was petroleum, its dollar worth being several times the combined value of all of the nonfuel minerals produced during the year. The petroleum production had the added advantage of making Burma one of the few Southeast Asian countries that was self-sufficient in energy needs. Burma's current mineral output is small by world standards, although it was a major producer of lead before World War II. It is still considered to have a good potential for expansion. Detailed geologic exploration is needed in several areas believed favorable for mineral occurrences.

The unstable security situation, however, has been a detrimental factor for a number of years. Detailed ground surveys and drilling needed for deposit evaluations have been delayed or canceled in some remote areas.

About 68,000 persons, or 0.5% of the active labor force, were employed in mining activities during 1979. During 1980, the mining sector probably accounted for about 2% of the net output of goods and services. Burma's mineral industry was managed primarily by four government-owned corporations. The No. 1 Mining Corp. controlled the lead, zinc, and silver output, which came mostly from the historic Bawdwin mining operations. The No. 1 Mining Corp. will also run the Monywa copper enterprise. The No. 2 Mining Corp. ran all the major tin and tungsten operations and the Heinze dredging project. The No. 3 Mining Corp. mainly was in charge of the Kalewa and Namma coal mines, the Moulmein and Loikaw antimony mines, and the planned direct-reduction steel plant. Industrial minerals such as barite, limestone, and gypsum were managed by the No. 4 Mining Corp.

The Burmese press reported that the fiscal year 1980-81 State budget showed that of a total planned investment of $832 million, $95 million, or 11.0% was allocated to the mining sector. In addition, $270 million was to go to the industrial sector, some of which would involve mineral-related projects. The $56 million earmarked for the electric power sector would also indirectly benefit some of the mineral sectors.

According to government statistics, the economic growth for fiscal year 1979-80 was good, with gross domestic product (GDP) growing by 5.6% in constant 1970 prices. At current prices, it grew at 11.2% to approximately $5.3 billion. Prices were rising somewhat, but the inflation rate for the year was expected to remain below 10%.

This was the fourth consecutive year in which the country achieved an increase in its rate of growth. Another important indicator, the ratio of fixed capital investment to GDP, reached 15.6% in 1979, compared with 7% in 1974. It appeared that the Burmese economy had overcome the stagnation of the late sixties and early seventies and was on the path to steady, sustained growth. Observers attributed the turnaround primarily to the policy changes since 1975-76, which have included the commercialization of State-run corporations, the introduction of a new bonus system for workers, and an effective tax reform.[2]

All sectors of the economy contributed to the growth in the GDP in fiscal year 1979-80. Agriculture accounted for 51% of the GDP and showed a real growth of 4.8%. The highest growth was in the construction

industry, which recorded a 24.1% increase. The mining sector also had an impressive growth rate of 17.6%.

In the fiscal year 1980-81 plan, the targeted real growth in GDP was set at 6.9% by the Government, a difficult but not unreasonable goal. The plan's breakdown by sector showed that the value of mining output was to increase by 17.2%, the highest of any sector. The next largest planned increase was 13.8% in the industrial sector.

In addition to the foreign assistance that it was receiving for the Bawdwin Mine and the Monywa copper project, Burma has also accepted foreign aid in several projects that benefit the entire economy and one that will benefit the overall mineral industry. The mineral-related project is to be a metallurgical research and development center at Ela in Lewe Township, 325 kilometers north of Rangoon. The Japanese International Cooperation Agency reportedly will finance the $8.4 million project.[3]

The Chinese have signed a protocol with Burma on economic and technical cooperation, whereby mainland China will provide financing amounting to 100 million yuan for eight unidentified projects. The Chinese have been helping Burma develop its electric power network for the past several years. A recently completed segment of the work was the installation of two 6,000-kilowatt generator sets and related infrastructure at the port of Moulmein at the mouth of the Salween River.

A number of other electric power projects are either underway or ready to be started. These consist of hydroelectric, gas turbine, or steam generator plants at several locations. A number of international agencies and several countries are reported to be helping both technically and financially.

Mostly as a result of foreign assistance, Burma's installed capacity for electric power generation has increased from about 250,000 kilowatts in 1970 to 435,800 kilowatts in 1980.[4] Total power generated in 1979 was just over 1 billion kilowatt-hours, of which 70% was hydroelectric, 21% was by natural-gas-fueled gas turbine, and the remainder by diesel and steam power.

PRODUCTION

By value, the principal mineral commodities produced in Burma were petroleum, lead, silver, tin, tungsten, and zinc. Crude oil production was the most valuable mineral output in 1980, as well as in 1979, primarily resulting from the increases in world petroleum prices and secondly from a moderate increase in output.[5] Under the Third 4-year plan (fiscal year 1978-79 through fiscal year 1981-82), the main objectives for the minerals sector were to increase production and to develop industrial self-sufficiency. During the first year of the current economic plan, a major metallogenic geologic survey and exploration project was completed delineating the country's existing resources and new mineral occurrences. Additionally, Burma's mining industry, which was invested under the control of four governmental corporations, succeeded in obtaining foreign assistance either through financing or technology and equipment. Since 1978, output by lead-zinc operations and associated byproduct silver were showing annual increases. Similarly, the tin-tungsten sector also reported annual increases in output. However, the output in minerals production was partly attributed to better control and reduced activities in smuggling.

Table 1.—Burma: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Antimony, mine output:					
Gross weight	1,140	1,331	1,477	1,690	1,094
Sb content[e]	r460	r530	r590	r680	440
Copper:					
Mine output, metal content	92	45	56	67	e56
Matte, gross weight	205	99	125	148	123
Iron and steel: Crude steel[e]	40,000	40,000	40,000	NA	NA
Lead:					
Mine output, metal content[e]	r7,650	r8,250	r9,900	r12,100	11,800
Metal:					
Refined, including secondary	3,331	4,833	4,975	6,237	5,686
Antimonial lead (18% to 20% Sb)	187	120	127	185	185

See footnotes at end of table.

Table 1.—Burma: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Nickel:					
Mine output, metal content[e]	24	17	18	18	14
Speiss, gross weight	94	69	70	67	57
Silver, mine output thousand troy ounces	211	355	377	340	418
Tin, mine output, metal content:					
Of tin concentrate	264	114	346	573	701
Of tin-tungsten concentrate	243	248	411	660	304
Total	507	362	757	1,233	1,005
Tungsten, mine output, metal content:					
Of tungsten concentrate	109	108	189	276	323
Of tin-tungsten concentrate	167	170	282	416	209
Total	276	278	471	692	532
Zinc, mine output, metal content	2,211	1,834	2,645	3,028	3,596
NONMETALS					
Barite[3]	15,681	16,096	35,320	39,486	39,689
Cement, hydraulic	233,130	269,000	254,000	390,606	[e]375,000
Clays:[3]					
Ball clay	5,762	4,674	4,573	4,294	4,390
Bentonite	955	975	1,377	1,446	1,347
Fire clay[4]	2,792	4,627	4,878	4,413	3,417
Industrial white clay	4,393	3,449	2,000	6,876	4,626
Feldspar[3]	1,709	1,422	2,000	2,004	1,689
Graphite[3]	161	96	280	268	199
Gypsum[3]	45,296	33,511	35,431	38,265	37,132
Pigments, mineral, natural: Iron oxide	616	230	461	369	228
Precious and semiprecious stones: Jadeite[3] kilograms	31,387	6,532	12,454	7,707	7,953
Salt thousand tons	126	230	304	258	268
Stone:[3]					
Dolomite	1,016	431	1,616	1,882	2,450
Limestone, crushed and broken thousand tons	645	1,159	1,437	1,259	1,151
Quartz	116	73	--	122	143
Talc and related materials: Soapstone[3]	238	201	391	394	333
MINERAL FUELS AND RELATED MATERIALS					
Coal	20,931	23,926	33,113	36,064	26,919
Gas, natural:					
Gross million cubic feet	13,300	16,000	17,000	18,000	[e]17,500
Marketed[3] do.	8,481	8,784	12,638	13,500	[e]13,500
Petroleum:					
Crude thousand 42-gallon barrels	8,183	9,178	9,995	10,822	[e]10,510
Refinery products:[5]					
Gasoline do.	1,646	1,864	1,864	2,008	[e]2,080
Jet fuel do.	216	248	[e]280	[e]300	[e]300
Kerosine do.	1,117	909	744	548	[e]450
Distillate fuel oil do.	2,045	2,351	2,500	2,626	[e]2,570
Residual fuel oil do.	1,012	1,279	1,532	1,396	[e]1,540
Lubricants do.	140	133	140	[e]140	[e]140
Other do.	177	179	[e]223	[e]220	[e]220
Total do.	6,353	6,963	7,283	7,238	[e]7,300

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 30, 1981.

[2]In addition to the commodities listed, pottery clay, common sand, glass sand, other varieties of crude construction stone, and other varieties of gem stones are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Data are for fiscal years beginning Apr. 1 of that stated.

[4]Includes fire clay powder.

[5]Data exclude products used as fuel in refineries.

TRADE

Detailed trade figures were not available for 1979 or 1980. The mining industry normally ranks third in value of exports after agriculture and forest products. In view of the increased production in the mining sector during fiscal year 1979-80, it is likely that mining increased its share of the total export value. Burma generally exports nearly all of its metallic mineral output, which is insignificant by world standards. Principal exports of Burma's mineral commodities include base metals and ores, sil-

ver, and cement.[6] Mineral fuels were consumed domestically, except for a small amount of petroleum exported. Crude oil export was necessitated not by a lack of internal demand, but rather by a lack of storage and refining capacity. Refined products have actually been in short supply during the last few years. A new refinery is under construction at Mann Oilfield to nearly double domestic refining capacity, and when it is completed in 1982 or 1983, it will utilize all of the excess crude oil available from the presently operating oilfields.

The overall export targets for the recent years were set at $273 million in fiscal year 1978-79, $380 million in fiscal year 1979-80, and $491 million for 1980-81. It was believed that actual export trade fell somewhat below the goal for fiscal year 1979-80.

In addition to the normal trade channels, there was reportedly a brisk trade of uncut precious and semiprecious gem stones, tin and tungsten concentrate, and nonmineral raw materials. This smuggling black market, or illicit trade, as it has been variously described, is apparently unofficially condoned by the Government. The smuggled material is bartered for scarce consumer goods which are in short supply in Burma. This trading or smuggling was estimated in the press to total a large proportion of the official foreign trade.[7]

COMMODITY REVIEW

METALS

Copper.—Construction was reported to have begun on the Monywa copper project. Design and technology for the concentrator and mines was being supplied by RTB Bor of Yugoslavia. The Yugoslavians will build and assist the Burmese in the early stages, but Burmese officials will be in charge of management and operation. Concentrate will be exported. Ore will come from the Kyesintaung and Sabetaung deposits, just west of the Chindwin River, opposite the railhead town of Monywa.

In March 1980, Burma and Finland signed an agreement concerning a feasibility study for the construction of a copper smelter and refinery. The Finnish firm of Outokumpu will conduct the study.[8]

Iron and Steel.—It was believed that the country's first direct-reduction steel plant was under construction at Anisakan in Maymyo Township. The turnkey contract for a Kinglor Metor process plant was signed in July 1979. The plant will be the first of its type outside of Italy. The process uses noncoking coal as a reductant and natural gas as the major fuel. Planned capacity was 20,000 tons per year of metal. A 15- to 17-ton electric arc furnace will smelt the iron into steel.

Lead, Zinc, and Silver.—Two feasibility studies financed by the Federal Republic of Germany were underway during 1980 at the Bawdwin Mine in Namtu. The first was to examine the possibility of producing zinc oxide from the lead smelter slag. The zinc-rich slag and tailings have been accumulating for over 65 years. The second study was to examine the possibility of leaching silver from the tailings of the lead-zinc flotation plant. The studies were scheduled for completion by yearend 1980.

Production of refined lead has increased annually since 1975, reaching close to 6,000 tons in fiscal year 1979-80. However, annual output of zinc concentrate during the same period has been erratic, but averaged around 4,700 tons per year, compared to a reported production of 6,400 tons in fiscal year 1979-80. Refined silver output increased proportionately as a byproduct function of lead refining. Increased output by the lead-zinc industry probably reflects the acquisition of new equipment and rehabilitation of plant facilities completed around yearend 1979.

Tin and Tungsten.—Tungsten resources are associated with tin occurrences in Burma. Both tin concentrates and tungsten concentrates are produced, as well as mixed tin and tungsten concentrates, which presently constitute the final form in which they are exported. Currently, the ratio of tin, tungsten, and mixed tin-tungsten output is 2 to 1 to 4, respectively.

Exploitation of the tin-tungsten deposits along the Tenasserim Coast in southern Burma was to begin at yearend 1980 with delivery of a new dredge. The dredge departed from Singapore, where it was built, in October and was scheduled to begin working as soon as possible.

A further study of the Tenasserim Div. tin resources was to be conducted under Asian Development Bank financing. The study is to develop a feasibility plan for exploiting some of the known onshore deposits.

In February 1980, Burma announced plans to construct a small tin smelter in

Syriam under an economic and technical cooperation agreement signed with North Korea. Although Burma reported output of 1,233 tons of tin in concentrate in 1979, it was believed that much more was actually produced and the excess smuggled out of the country. It is possible that when the smelter is built, it will furnish a more readily accessible market for the concentrate and hence cut down on at least some of the widespread smuggling.

NONMETALS

Burma's nonmetallic mineral production was generally oriented toward domestic consumption. Nonmetallic minerals were not produced in sufficient quantity to be significant in the world market, except certain gem minerals. Barite was probably the most valuable industrial mineral marketed. The Government was trying to increase production and had a ready export market for any barite not used in its own oil and gas well-drilling program. Bentonite, various other types of clays, feldspar, graphite, gypsum, jadeite and other gem stones, iron pigments, salt, and limestone were also produced during the year. Three cement kilns were believed operating at Thayetmyo on the west bank of the Irrawaddy River. Their combined capacity was about 1,000 tons per day. A new cement plant is now operating at Kyangin. An increase in cement production was planned for 1980 to support increased construction activity. Brick production increased over 20% during the first 6 months of 1980.

MINERAL FUELS

Petroleum.—During recent years, Burma has maintained a firm policy of not importing petroleum. This has led to shortages that have dampened plans for industrial and mineral development. However, annual crude production has increased steadily since fiscal year 1975-76, and according to government statistics, it continued the trend with a 6% increase during the first third of 1980. The Burmese set a production goal of 14 million barrels of crude oil for fiscal year 1981.

Crude production surpassed the country's ability to refine it in 1979, and the small surplus was exported to furnish much needed foreign exchange. Three steps were undertaken to eliminate the refined product shortages, two completed in 1980. The first was the addition of a 6,000-barrel-per-day crude topping unit at the Syriam refinery near Rangoon, completed in August; the second was a 2,000-barrel-per-day refinery at Malun, 20 miles south of the Mann Oilfield, completed in October; the third, and most important step, was a new 25,000-barrel-per-day refinery which was being built near the Mann Oilfield with a loan from the Japanese Government. The refinery should meet almost all of Burma's petroleum product needs for several years to come if completed as planned in late 1981 or early 1982.[9]

The Burmese Government, through its own exploration crews and several contracts with foreign survey experts, has been conducting an active search for further oil and gas reserves. Twenty-nine drilling rigs were involved in the onshore exploration, and indications of hydrocarbons reportedly were found in many of 72 test wells drilled in the first half of 1980. Considerable evaluation work will be needed to determine the commercial viability of these tests.

Natural Gas.—Flaring of associated natural gas was essentially stopped in 1975. Gas is now used for electric power generation, fertilizer manufacture, and powering industrial plants, or is reinjected to pressurize the oilfields. Gas production jumped over 600% in the last decade.

Gas strikes were reported at Kyaiklat in the Irrawaddy Delta and in the Indaw area of the upper Chindwin Valley. The Indaw strike reportedly contained substantial reserves, but unfavorable terrain conditions would make development very difficult.

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[1]Physical scientist, Branch of Foreign Data.

[2]U.S. Dept. of State, American Embassy, Rangoon, Burma. Foreign Economic Trends and Their Implications for the United States. No. 80-025, April 1980.

[3]Rangoon Home Service (radio broadcast) 1330 hours G.m.t., Dec. 7, 1979.

[4]Selected Monthly Economic Indicators, Central Statistical Organization, Rangoon, Burma. Statistical Paper No. 3, May-June 1980, p. 29.

[5]———. P. 34.

[6]———. P. 11.

[7]Thriving Market for Illicit Foreign Trade. Kuala Lumpur Business Times in English. Nov. 17, 1980, p. 19.

[8]Hong Kong AFP in English (radio broadcast) 1740 hours G.m.t., Mar. 11, 1980.

[9]Petroleum News. V. 11, No. 8, November 1980, p. 24.

The Mineral Industry of Canada[1]

By Charlie Wyche[2]

In 1980, the Canadian economy was characterized by slow growth in most major industrial sectors. Problems of inflation and unemployment, resulting from high energy costs and record high interest rates, were present throughout the year. However, the overall mineral industry continued to show strong growth. Both the mining and mineral processing industries reached record highs in terms of operating revenues and net profits, even though the volume of output dropped for a number of major metals. Prices increased significantly for oil, natural gas, coal, and such metal commodities as gold, silver, nickel, and uranium. There were approximately 129,000 persons employed directly in mining during 1980, and many more jobs were dependent on mining activity. The industry accounted for an estimated 645,000 jobs, directly and indirectly, or 6% of the Canadian employed work force.

A mixed level of activity described the Canadian fuel industry during 1980. Whereas the number of exploratory wells increased 62%, production of crude oil and natural gas liquids decreased. Sales of natural gas from both domestic and export sources declined in 1980. However, revenue from the sale of crude oil and natural gas increased significantly over that for 1979. Expenditures for exploration and development projects increased about 15%. Prices for coal and uranium remained strong; both industries grew and prepared for future expansion.

In October 1980, the Canadian Government introduced the National Energy Program (NEP). The NEP is intended to restructure the country's energy system on the basis of three general principles: Security, opportunity, and fairness. First, the Government wants to move Canada toward energy self-sufficiency by 1990 by reducing the demand for oil to 10% of total energy consumption in the residential, commercial, and industrial sectors. It intends to do so by offering incentives to encourage conservation and to shift consumption away from oil to natural gas and electricity. Second, the program intends to achieve at least 50% Canadian ownership of oil and gas production by 1990, and Canadian control of a significant number of the larger firms. Third, the Government seeks a more equitable distribution of energy costs and benefits among regions and consumers.

PRODUCTION

According to the Canadian Department of Energy, Mines, and Resources, the total value of Canada's mineral production reached $27.66 billion[3] in 1980. This figure represents 11.4% of the $243 billion gross national product (GNP) value. The value of nonfuel mineral output increased 22% over that of 1979 with the nonmetallic sector showing the greatest increase. The fuel production value, including coal, natural gas, and petroleum, increased 26%. Although the volume of output for both gold and silver declined, the value of output increased 73% and 71%, respectively. Nickel showed a 54% increase in volume and a 102% increase in value. Of the major nonmetals and structural materials, only clay products declined in value. The value of fuel production reached a record $18.5 billion in 1980. The growth of the Canadian oil and gas industry remained stable in 1980 as discoveries made in 1979 were proven up. Production, consumption, and export of coal increased, and a number of new contracts were signed. Activity accelerated at several locations in western Canada as existing mines prepared to expand capacity and new mines prepared for production in early 1981.

Value of mineral output increased in 8 of the 10 Provinces and in 1 of the 2 Territories. The Province of Alberta alone, with its large oil and gas output, accounted for approximately 52% of Canada's total mineral value in 1980. Production values of the Provinces and Territories follow:

Province or Territory	Value, billion dollars	
	1979	1980
Alberta	11.0	14.3
Ontario	2.8	4.0
British Columbia	2.3	2.4
Quebec	1.9	2.1
Saskatchewan	1.5	2.0
Newfoundland Labrador	.94	.92
Manitoba	.50	.70
New Brunswick	.45	.34
Northwest Territories	.35	.33
Yukon Territory	.26	.26
Nova Scotia	.17	.22
Prince Edward Island	(1)	(1)
Total	22.17	27.57

[1]Less than 1/2 unit.

In 1980, Canada was the world's largest producer of asbestos, nickel, and zinc; the second largest producer of potash, gypsum, silver, molybdenum, and sulfur; and a leading producer of uranium, titanium, aluminum, cobalt, gold, lead, copper, iron ore, and platinum. More than 60 commodities were produced from mining activities conducted in every region of the country. There were 16 smelters, 15 refineries, and more than 250 mills operating throughout the country.

Table 1.—Canada: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Alumina, gross weight thousand tons	490	1,061	1,054	824	[e]900
Metal:					
Primary	[r]631,000	973,524	1,048,469	863,600	1,074,500
Secondary	42,459	48,308	74,752	75,000	75,000
Antimony[e 2]	2,300	3,175	[r]3,005	[r]2,954	[e]3,000
Bismuth[3]	130	165	145	139	171
Cadmium[4]	1,314	1,185	964	1,209	1,053
Calcium kilograms	513,964	490,856	574,674	455,713	525,000
Cobalt:					
Mine output, metal content[5]	1,356	1,485	1,234	1,640	1,603
Metal[6]	298	459	519	475	470
Columbium and tantalum:					
Columbium concentrate (pyrochlore):					
Gross weight[e]	2,497	4,182	4,122	4,186	3,884
Cb content	1,048	1,754	1,729	1,756	1,629

See footnotes at end of table.

Table 1.—Canada: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Columbium and tantalum —Continued					
Tantalum concentrate:					
Gross weight[e]	235	270	283	355	350
Cb content	7	8	8	9	e9
Ta content	105	120	126	130	104
Copper:					
Mine output, recoverable metal content[7]	730,930	759,423	659,380	636,383	708,416
Metal, primary and secondary:					
Blister and anode	488,594	500,274	425,300	384,500	492,700
Refined	510,469	508,767	446,278	397,263	505,238
Gold, thousand troy ounces	1,692	1,734	1,735	1,735	1,581
Iron and steel:					
Iron ore:[8]					
Gross weight, thousand tons	r55,555	r57,638	41,751	59,888	48,754
Iron content, do.	36,608	36,168	26,228	37,681	30,803
Metal:					
Pig iron, do.	9,800	9,661	10,340	10,906	10,893
Ferroalloys, do.	225	193	200	175	289
Crude steel, do.	13,290	13,631	14,898	16,078	15,901
Semimanufactures[9], do.	9,821	10,461	11,894	12,235	e11,820
Lead:					
Mine output, metal content	256,324	280,955	319,809	310,745	273,833
Metal, refined:					
Primary	175,720	187,457	194,054	183,800	162,480
Secondary	55,300	53,100	51,800	68,600	72,100
Magnesium metal, primary	6,092	7,633	8,309	9,015	8,899
Molybdenum	14,619	16,568	13,943	11,174	12,198
Nickel:					
Mine output, metal content[10]	240,825	232,512	128,310	126,481	194,947
Metal, smelter	r168,250	r151,967	89,231	83,747	152,299
Platinum-group metals, troy ounces	416,821	465,371	346,212	197,943	404,584
Selenium, refined[11], kilograms	226,419	410,552	392,777	511,704	e453,600
Silver, thousand troy ounces	41,199	42,236	40,733	36,874	33,340
Tellurium, refined[11], kilograms	53,141	37,021	45,299	47,174	e45,360
Tin, mine output, metal content	274	328	360	337	264
Titanium:					
Ilmenite, gross weight, thousand tons	2,115	1,442	1,810	1,219	e1,320
Sorel slag (70%-72% TiO_2)	814,040	692,341	850,032	477,040	874,717
Tungsten, mine output, W content	1,720	1,812	2,289	2,581	3,688
Uranium oxide (U_3O_8)	6,635	6,824	8,211	7,701	7,509
Zinc:					
Mine output, metal content	982,057	1,070,515	1,066,902	1,099,926	894,575
Metal, refined, primary	472,316	r494,888	495,420	580,449	591,565
NONMETALS					
Asbestos, thousand tons	1,536	1,517	1,422	1,493	1,335
Barite	100,266	116,950	87,996	67,131	e85,000
Cement, hydraulic[12], thousand tons	9,624	9,640	10,318	11,001	10,344
Clays and clay products[13], value, thousands	$97,500	$103,360	$109,635	$142,356	$133,611
Diatomite	2,737	1,239	2,184	1,452	e2,000
Fluorspar (70% CaF_2)	64,000	59,500	--	--	--
Gypsum and anhydrite, thousand tons	6,002	7,234	8,074	8,098	7,209
Lime, do.	1,850	1,900	2,034	1,859	2,063
Magnesite, dolomite, brucite, value, thousands	$4,007	$6,290	$5,990	$10,531	$12,167
Nepheline syenite	540,121	574,558	599,121	605,699	592,000
Nitrogen, N content of ammonia	1,258,100	1,763,600	1,926,200	1,981,300	e1,995,800
Pigments, mineral: Iron oxides, natural	--	--	--	2,700	e2,800
Potash, K_2O equivalent, thousand tons	r5,215	r5,764	6,340	7,074	7,532
Pyrite and pyrrhotite, gross weight	30,754	r24,119	9,203	31,032	32,000
Salt, thousand tons	5,994	6,039	6,452	6,881	7,029
Sand and gravel, do.	249,159	262,905	272,092	285,221	327,860
Silica (quartz), do.	2,520	2,317	2,165	2,368	2,624
Sodium compounds, n.e.s.:					
Sodium carbonate[e]	450,000	450,000	450,000	450,000	450,000
Sodium sulfate	r460,193	r394,795	376,563	443,279	496,000
Stone[14], thousand tons	87,876	120,163	122,144	109,719	103,281
Strontium minerals: Celestite[e]	12,000	--	--	--	--
Sulfur:					
Elemental byproduct:					
Of smelter gases, thousand tons	705	r736	676	667	903
Of sour natural gas, do.	6,241	6,475	6,248	5,935	6,000

See footnotes at end of table.

Table 1.—Canada: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sulfur —Continued					
Elemental byproduct —Continued					
Of refineries ——— thousand tons	200	160	200	200	190
Of tar sands ——— do	100	100	118	213	300
S content of pyrite and pyrrhotite[e] ——— do	[r]15	[r]12	5	12	12
Talc, soapstone, pyrophyllite	68,834	72,400	61,661	90,330	87,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	134,000	134,000	130,000	135,000	135,000
Coal:					
Bituminous and subbituminous thousand tons	20,812	23,201	25,419	28,006	30,576
Lignite ——— do	4,676	5,479	5,058	5,011	5,976
Coke, high-temperature ——— do	5,289	4,906	4,968	5,775	[e]5,200
Gas, natural:					
Gross ——— million cubic feet	3,515,844	3,588,500	3,569,046	3,780,145	3,541,024
Marketed ——— do	3,096,510	3,160,525	3,128,056	3,334,618	3,067,711
Natural gas liquids:					
Gross:					
Butane ——— thousand 42-gallon barrels	22,562	22,976	21,133	22,820	21,200
Propane ——— do	34,078	34,695	32,792	35,844	34,159
Pentanes plus ——— do	47,953	47,468	42,423	42,038	38,089
Ethane ——— do	NA	NA	6,329	20,612	27,319
Condensate ——— do	1,032	1,138	1,174	1,255	1,186
Total ——— do	105,625	106,277	103,851	122,569	121,953
Returned to formation, all types ——— do	44	400	397	[e]400	NA
Peat	394,183	[r]386,408	435,457	480,087	488,000
Petroleum:					
Crude[15] ——— thousand 42-gallon barrels	488,680	482,021	478,435	545,465	523,441
Refinery products:					
Gasoline:					
Aviation ——— do	1,477	1,481	1,460	1,572	1,472
Other ——— do	222,660	225,593	230,616	240,554	241,778
Jet fuel ——— do	25,146	25,597	28,100	30,867	30,537
Kerosine ——— do	27,047	26,064	23,557	24,991	24,184
Distillate fuel oil ——— do	159,302	169,728	166,974	184,002	181,930
Residual fuel oil ——— do	102,385	112,791	108,665	113,730	102,124
Lubricants ——— do	4,140	4,287	4,551	5,366	5,720
Other:					
Liquefied petroleum gas ——— do	10,514	11,360	13,070	13,485	13,520
Petrochemical feedstocks ——— do	13,097	23,497	29,683	35,059	32,894
Asphalt ——— do	17,396	18,422	18,628	21,241	20,907
Petroleum coke ——— do	1,358	1,269	1,258	1,029	1,218
Unspecified ——— do	8,757	7,217	3,711	5,440	5,310
Refinery fuel and losses ——— do	31,283	31,697	33,742	34,491	32,035
Total ——— do	624,562	659,003	664,015	711,827	693,629

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 16, 1981.

[2]Sb content of antimonial lead alloys, flue dust, and doré slag estimated on the basis of reported gross production.

[3]Refined metal and bullion from domestic ores plus recoverable Bi content of exported concentrates.

[4]Refined metal from domestic ores plus recoverable Cd content of exported ores and concentrates.

[5]Actual output not reported. Data represent Co content of all products derived from ores of Canadian origin, including nickel oxide sinter shipped to the United Kingdom and nickel-copper-cobalt matte shipped to Norway for further processing.

[6]Actual output not reported. Data represent the output within Canada of metallic cobalt from ores of both Canadian and non-Canadian origin.

[7]Blister copper from domestic ores plus recoverable Cu content of exported matte and concentrates.

[8]Series revised to reflect actual mine production rather than sales, which were reported as production in previous editions. Sales figures, on a gross weight basis, in thousand metric tons, follow: 1976—55,416; 1977—53,621; 1978—42,931; 1979—59,617; 1980—50,866.

[9]Includes shipments of ingots from primary plants for rolling elsewhere.

[10]Refined nickel from domestic ores plus Ni content of oxide produced and recoverable Ni content of exported matte.

[11]From all sources, including imports and secondary sources.

[12]Cement shipped and/or used by producers.

[13]Includes bentonite products from common clay, stoneware clay, fire clay, and other clays.

[14]Crushed, building, ornamental, paving, and similar stone.

[15]Including synthetic crude (from oil shale and/or tar sands).

TRADE

In 1980, Canada exported about 45% of its crude mineral production to more than 90 countries. Export values of crude and fabricated mineral products were estimated at $21.6 billion, or 35% of Canada's total commodity exports. Some producers faced fierce competition in export markets as economic decline reduced consumption to record low levels. This was reflected in trade figures for crude ferrous metals, where exports declined 11.5% compared with those of 1979. In crude nonferrous, nonmetallic minerals, and fuels, exports increased substantially. Total crude mineral exports (ores, concentrates, and mattes) reached $1.9 billion.

Import values totaled $8.6 billion, of which fuels and metallic mineral products accounted for $8.3 billion. Crude petroleum alone accounted for $5.9 billion, or 69% of total mineral imports. Principal sources of oil imports were Venezuela and Saudi Arabia. Imports of coal, valued at $643 million, were from the United States. Other major mineral imports were bauxite, alumina, and aluminum scrap ($286 million), iron ore and iron and steel scrap ($292 million), and phosphate rock ($115 million).

Table 2.—Canada: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina excluding abrasive grades, Al content	32,698	26,543	23,356	United Kingdom 861; France 765.
Metal:				
Scrap	57,773	70,465	49,877	Japan 14,216; West Germany 1,569.
Unwrought	r863,532	551,889	333,186	Japan 72,482; China, mainland 33,956.
Semimanufactures[1]	40,407	36,585	27,615	Morocco 2,004; Pakistan 1,511.
Cadmium	r1,260	1,293	721	United Kingdom 561.
Calcium metal	280	377	166	Mexico 145.
Cobalt:				
Metal	826	302	266	Republic of South Africa 11; West Germany 10.
Oxides and salts, gross weight	748	559	114	United Kingdom 428; Belgium-Luxembourg 17.
Columbium ore[2] kilograms	552,656	509,952	509,952	
Copper:				
Ore and matte, Cu content	282,158	314,866	5,091	Japan 233,502; U.S.S.R. 20,772; Norway 20,592.
Slag, skimmings, and sludge, Cu content	r66	243	243	
Metal:				
Scrap:				
Unalloyed	16,905	15,896	11,861	Republic of Korea 1,456; Belgium-Luxembourg 929.
Alloyed	r24,312	24,665	12,134	Belgium-Luxembourg 5,379; India 1,468; Japan 1,153.
Unwrought, unalloyed	r247,750	191,137	71,053	United Kingdom 54,949.
Semimanufactures:				
Unalloyed	29,611	29,713	18,202	Venezuela 2,411.
Alloyed	r22,692	18,786	17,286	Venezuela 398; United Kingdom 254.
Gold:				
Ore and concentrate, Au content thousand troy ounces	r256	201	20	Japan 154; West Germany 8; Spain 6.
Metal:				
Unalloyed do	1,526	1,589	1,341	Japan 78; United Kingdom 39; Hong Kong 36.
Alloyed do	104	201	57	Brazil 129; Italy 8.
Iron and steel:				
Ore and concentrates thousand tons	31,929	48,849	22,856	Netherlands 6,541; United Kingdom 6,184; Italy 2,474.
Metal:				
Scrap do	874	1,033	696	Italy 156; Turkey 41.
Pig iron and related materials do	602	394	194	Spain 79; Netherlands 41; Italy 39.
Ferroalloys:				
Ferromanganese	20,193	12,043	11,962	Jamaica 81.
Ferrosilicon	60,197	40,731	31,550	Japan 5,553; West Germany 2,634.
Other	13,028	9,964	6,346	United Kingdom 2,330; Netherlands 1,020.
Steel ingots and other primary forms	280,963	120,787	58,983	Malaysia 20,049; Republic of Korea 15,262.

See footnotes at end of table.

Table 2.—Canada: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	r792,292	864,004	778,054	NA.
Universals, plates, sheets, strip	1,031,020	930,314	753,689	Thailand 58,862; Italy 29,188.
Rails and accessories	195,565	233,221	111,450	Italy 39,241; Mexico 27,314.
Wire	r85,165	85,339	83,036	Chile 321; Hong Kong 318.
Tubes, pipes, fittings	r381,244	421,412	410,146	Panama 1,884; United Kingdom 1,667.
Castings and forgings, rough	r191,509	190,577	186,182	India 3,362.
Lead:				
Ore and concentrate, Pb content	r142,693	151,494	35,990	Japan 72,613; West Germany 18,955.
Metal:				
Scrap including alloy scrap	r17,636	21,882	5,641	West Germany 5,878; Sweden 4,235.
Unwrought, unalloyed	131,950	117,992	61,183	United Kingdom 38,233; Italy 6,682.
Semimanufactures	r8,759	9,682	8,708	United Kingdom 729.
Magnesium metal	4,815	6,051	1,083	West Germany 1,805; Japan 1,364; United Kingdom 1,019.
Mercury[2] 76-pound flasks	r376	397	397	
Molybdenum ore and concentrate, Mo content[3]	13,421	11,482	1,176	Belgium-Luxembourg 2,926; Japan 2,262; United Kingdom 1,956.
Nickel:				
Ore, matte, and speiss, Ni content	39,077	42,735	--	Norway 26,733; United Kingdom 16,002.
Oxide, Ni content	27,792	17,190	8,413	NA.
Metal:				
Scrap	2,308	2,401	1,515	Netherlands 335; Japan 157.
Unwrought	r107,253	85,355	57,611	NA.
Semimanufactures	r15,179	12,298	9,822	Netherlands 491; Belgium-Luxembourg 481.
Platinum-group metals:				
Concentrates, residues, and mattes, metal content troy ounces	339,419	157,719	1,233	United Kingdom 152,368; Brazil 2,601.
Metals:				
Scrap do	42,580	53,520	49,530	West Germany 2,720; Japan 1,000.
Other do	34,727	57,196	28,607	Japan 12,031; United Kingdom 11,991; Brazil 3,110.
Selenium metal and salts, Se content kilograms	242,218	289,210	158,077	United Kingdom 95,481; Japan 8,890.
Silver:				
Ore and concentrate, Ag content thousand troy ounces	r15,524	13,387	6,755	Japan 3,880; West Germany 1,335.
Metal, refined do	34,628	29,679	29,451	Jamaica 47; Trinidad and Tobago 46; Japan 45.
Tin ore and concentrate, Sn content	943	713	638	Hong Kong 46; Mexico 25.
Titanium: Ilmenite and ilmenite sand[2 4]	r46,847	139,447	139,447	
Uranium and thorium concentrates value, thousands	r$181,604	$323,427	$296,558	United Kingdom $16,093; Italy $10,767.
Zinc:				
Ore and concentrate, Zn content	r688,186	598,279	116,096	Japan 175,916; Belgium-Luxembourg 169,581.
Metal:				
Scrap, dross, ash, blue powder	r23,381	19,084	13,773	United Kingdom 2,975; West Germany 1,008.
Unwrought	439,340	429,367	262,017	United Kingdom 46,989; Brazil 20,373.
Semimanufactures	1,329	1,955	1,493	Singapore 151; New Zealand 124.
Other:				
Ores and concentrates, gross weight	r160,621	343,731	148,843	West Germany 93,364; Japan 34,500; Austria 23,196.
Ash and residue containing nonferrous metals	r12,989	18,567	11,577	Taiwan 4,799; Belgium-Luxembourg 1,019.
Oxides, hydroxides, peroxides of metals, n.e.s	91,430	102,304	100,045	West Germany 526; Australia 348; United Kingdom 331.
Metals:				
Base metals including alloys, all forms	r1,367	1,656	1,232	Japan 134; Australia 21.
Precious metals[5] troy ounces	390	8,506	5,125	United Kingdom 3,294.
NONMETALS				
Abrasives:				
Natural	1,065	165	165	
Fused alumina, crude and grains	r167,364	183,159	178,447	United Kingdom 4,658; Denmark 27.
Silicon carbide, crude and grains	r107,351	84,546	82,401	Japan 1,419.

See footnotes at end of table.

Table 2.—Canada: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Abrasives —Continued				
Grinding and polishing wheels and stones ____ value, thousands__	r$521	$698	$475	United Kingdom $68; New Zealand $57.
Asbestos:				
Crude_____	1	20	20	
Milled fiber, all grades thousand tons__	1,399	1,461	505	West Germany 154; Japan 136.
Barite, crude _____	56,783	2,038	2,038	
Cement, portland____ thousand tons__	1,635	2,289	2,289	
Clays and clay products including all refractory products:				
Crude_____do____	1,103	1,050	1,050	
Products:				
Refractory including nonclay bricks[6] _____	54,409	74,318	34,537	Venezuela 12,360; Mexico 4,375; Saudi Arabia 2,811.
Nonrefractory value, thousands__	r$3,850	$2,949	$2,938	Mexico $4; St. Pierre and Miquelon $3.
Diamonds:				
Gem _____ carats__	36,805	34,571	5,170	Belgium-Luxembourg 14,425; Israel 7,595; Japan 1,974.
Industrial including dust ___do____	r140,541	174,752	119,932	Chile 20,287; Australia 19,376; Ireland 6,220.
Fertilizer materials:				
Nitrogenous____ thousand tons__	1,284	1,338	1,299	Philippines 17; China, mainland 10.
Potassic _____do____	r9,276	10,643	7,716	Japan 673; Brazil 545.
Other including mixed ____do____	558	598	508	Pakistan 60.
Ammonia _____do____	481	484	484	
Gypsum, crude _____do____	5,179	5,475	5,438	Bahamas 37.
Lime _____	478,551	490,863	488,686	Honduras 1,270; Panama 307; Australia 236.
Nepheline syenite _____	r420,962	471,057	440,528	Italy 11,538; United Kingdom 11,206; Netherlands 2,328.
Pigments, mineral including processed iron oxides _____	r26,854	22,300	20,836	Poland 1,295; Australia 56.
Precious and semiprecious stones, except diamond____ value, thousands__	r$3,521	$5,351	$1,532	Japan $1,272; Australia $495.
Salt and brine____ thousand tons__	1,609	1,822	1,799	St. Pierre and Miquelon 9; Guyana 8.
Sand and gravel _____do____	270	326	325	NA.
Sodium sulfate _____	r129,120	193,347	191,489	Philippines1,290; Guyana 454.
Stone:				
Limestone, crude, crushed, and refuse thousand tons__	1,711	2,296	2,296	
Quartzite _____do____	68	61	61	
Rough building and crude, n.e.s. do____	r312	305	233	Barbados 51; Bahamas 14.
Sulfur:				
Crude and refined _____do____	4,985	5,155	1,239	Republic of South Africa 480; Brazil 424.
Sulfuric acid including oleum do____	205	139	139	
Talc, steatite, soapstone, pyrophyllite[2 7] _	r560	2,096	2,096	
Other nonmetals, crude n.e.s. value, thousands__	r$73,961	$45,691	$6,175	West Germany $10,283; Belgium-Luxembourg $9,223.
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous ____ thousand tons__	13,658	13,853	33	Japan 10,563; Republic of Korea 928; West Germany 513.
Coke from coal _____	r217,596	228,601	164,138	West Germany 62,963.
Gas, natural_____ million cubic feet__	r882,593	990,493	990,493	
Petroleum:				
Crude_ thousand 42-gallon barrels__	97,984	105,260	105,260	
Refinery products:				
Gasoline _____do____	r6,115	5,674	3,788	Netherlands 510.
Distillate fuel oil _____do____	r10,836	14,940	4,006	Netherlands 3,434; Argentina 806.
Residual fuel oil_____do____	16,831	14,993	13,404	Italy 436.
Lubricants _____do____	21	39	28	St. Pierre and Miquelon 2.
Liquefied petroleum gas do____	r13,914	18,437	18,434	Japan 3.

See footnotes at end of table.

Table 2.—Canada: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Asphalt thousand 42-gallon barrels	649	1,035	1,024	United Kingdom 5; St. Pierre and Miquelon 4.
Petroleum coke and pitch coke do	r818	761	544	Japan 217.
Total do	r49,184	55,879		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals do	r4,707	17,364	17,142	Netherlands 113; United Kingdom 84.

rRevised. NA Not available.
[1]May include relatively minor quantities of certain shapes not normally included among semimanufactures.
[2]Partial figures: Data given are for U.S. imports for consumption only.
[3]Includes some scrap.
[4]Largely, if not all, used in the production of heavy aggregate.
[5]Excludes scrap and sweepings valued at $27,312,000 in 1978 and $91,638,000 in 1979.
[6]Total excludes quantity valued at $6,400,000 in 1978 and $10,522,000 in 1979.
[7]Total excludes quantity valued at $8,087 in 1978 and $12,063 in 1979.

Table 3.—Canada: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite thousand tons	r2,434	2,150	31	Guinea 841; Guyana 649; Brazil 320.
Alumina do	1,056	953	155	Australia 468; Jamaica 178.
Metal including alloys:				
Scrap	27,161	30,681	30,639	United Kingdom 21.
Unwrought	r11,481	23,985	18,838	Venezuela 1,933; United Kingdom 1,850; Norway 543.
Semimanufactures including cable	r42,887	59,109	47,896	Venezuela 5,992.
Antimony oxides	r907	794	69	United Kingdom 646; Belgium-Luxembourg 69; France 10.
Chromium:				
Ore and concentrates, Cr content	r28,497	27,373	11,122	Mozambique 9,166; Philippines 3,865; Republic of South Africa 2,788.
Oxide and hydroxide	r1,644	1,908	1,780	United Kingdom 75; West Germany 53.
Copper:				
Ore and concentrate, Cu content, metal content	18,427	2,640	2,315	Australia 325.
Copper sulfate	886	542	194	Republic of South Africa 342; United Kingdom 6.
Metal:				
Scrap including alloyed	27,539	35,443	35,193	Peru 128; Switzerland 55.
Unalloyed:				
Unwrought	r21,441	32,541	19,405	West Germany 7,987; Republic of South Africa 1,999.
Semimanufactures	r7,509	6,573	4,531	Japan 1,164.
Alloys, unwrought and semimanufactures including cable[1]	r20,486	20,957	13,118	West Germany 3,076; United Kingdom 2,826.
Gold:				
Ore and concentrate troy ounces	11,151	24,886	19,024	Peru 4,895.
Metal including alloys thousand troy ounces	r1,286	2,962	2,842	Nicaragua 57; Switzerland 48.
Iron and steel:				
Iron ore thousand tons	4,686	5,913	5,051	Brazil 792; Sweden 45; Norway 24.
Metal:				
Scrap do	952	1,047	1,045	NA.
Pig iron and related materials	r10,587	19,780	16,513	Brazil 2,142; France 832.
Ferroalloys:				
Ferrochrome	r30,432	34,720	12,707	Republic of South Africa 15,923; Brazil 4,350; Sweden 972.

See footnotes at end of table.

Table 3.—Canada: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Ferroalloys —Continued				
Ferromanganese including spiegeleisen	r26,812	83,680	19,485	Republic of South Africa 22,129; Brazil 10,500; Portugal 8,892.
Silicomanganese	15,842	21,876	12,079	Norway 6,776; Republic South Africa 1,521; Brazil 1,500.
Ferrosilicon	10,487	19,840	17,815	Norway 1,452; Sweden 279.
Ferrotungsten	73	27	6	United Kingdom 21.
Ferrovanadium	r151	349	349	
Other	r17,364	6,699	4,090	France 1,751; Brazil 654.
Steel, primary forms	r54,553	180,240	172,900	Republic of South Africa 1,222.
Semimanufactures:				
Bars, rods, angles, shapes, sections:				
Wire rod	190,349	166,243	5,795	France 54,652; Japan 52,028; Republic of South Africa 20,571.
Other bars and rods	r127,987	134,271	81,744	United Kingdom 27,649; Japan 6,337.
Angles, shapes, sections	r151,502	276,163	86,661	Belgium-Luxembourg 62,225; West Germany 31,373.
Universals, plates, sheets	r704,205	1,041,193	400,480	Japan 152,096; United Kingdom 148,483; West Germany 97,249.
Rails and accessories	27,636	20,636	17,520	Belgium-Luxembourg 2,488.
Wire	57,584	60,942	13,979	United Kingdom 19,375; France 7,291; Japan 5,214.
Tubes, pipes, fittings	r316,350	283,423	114,034	Japan 128,109.
Castings and forgings	r116,473	139,118	117,349	United Kingdom 11,189.
Lead:				
Oxide	322	331	195	Mexico 61; Republic of South Africa 57.
Metal including alloys, unwrought and semimanufactures	3,984	2,634	2,607	West Germany 20.
Magnesium metal including alloys	r2,526	3,147	2,954	United Kingdom 189.
Manganese:				
Ore and concentrates, Mn content	r136,446	45,150	5,182	Brazil 10,996; Gabon 9,552.
Metal	r7,943	8,275	247	Republic of South Africa 7,811; Japan 217.
Mercury 76-pound flasks	r1,249	1,471	768	Spain 675.
Molybdenum: Molybdic oxide, gross weight	r330	336	297	Sweden 28.
Nickel:				
Ore and concentrate including scrap, Ni content	r31,903	21,176	3,252	Australia 8,368; United Kingdom 4,455; France 2,832.
Metal including alloys:				
Unwrought	r1,439	3,317	1,774	Norway 1,511; France 19.
Semimanufactures	r7,591	7,952	5,519	United Kingdom 1,210; West Germany 647.
Platinum-group metals and silver:				
Ore and concentrates, platinum-group metals and silver content thousand troy ounces	9,676	187,678	184,461	United Kingdom 1,795; Bolivia 685.
Metals including alloys:				
Platinum-group troy ounces	56,169	26,585	22,117	United Kingdom 4,375.
Silver thousand troy ounces	1,157	1,195	1,069	United Kingdom 99.
Sodium metal	7,260	8,237	8,234	United Kingdom 3.
Tin metal, unwrought and semimanufactures	5,128	5,123	3,402	United Kingdom 566; Bolivia 410.
Titanium:				
Dioxide, pure and extended	r7,094	11,330	3,968	West Germany 2,521; United Kingdom 2,365; France 1,806.
Metal	r641	731	661	United Kingdom 55.
Tungsten ore and concentrate, W content	1	11	11	
Zinc:				
Ore and concentrate including scrap, Zn content	r6,145	9,867	3,540	Bolivia 4,051; Peru 1,938; Japan 338.
Oxide and peroxide	r2,067	1,717	1,370	United Kingdom 273; Netherlands 41.
Metal:				
Blue powder	r272	304	303	United Kingdom 1.
Unwrought	2,405	2,573	222	Peru 2,350.
Semimanufactures	r1,318	1,421	995	Belgium-Luxembourg 125; Peru 120.
Zirconium metal alloys	326	312	267	United Kingdom 36.
Other:				
Ores and concentrates including scrap, gross weight	r118,003	116,987	77,318	Australia 32,160; Peru 2,181.
Oxides, hydroxides, peroxides of metals, n.e.s	r6,483	15,221	13,106	Republic of South Africa 998.
Base metals including alloys, all forms	r2,254	1,844	1,490	United Kingdom 83; Japan 71.
Precious metals, n.e.s troy ounces	r37,922	379,231	375,543	Italy 2,202; West Germany 955.

See footnotes at end of table.

Table 3.—Canada: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives:				
Natural	r13,505	17,764	17,522	West Germany 180; Belgium-Luxembourg 54.
Grinding and polishing wheels and stones, value, thousands	r$11,595	$16,315	$11,350	Italy $1,375; West Germany $902.
Asbestos	r766	1,953	802	Republic of South Africa 1,106; West Germany 45.
Barite, crude	r18,230	8,398	8,389	United Kingdom 9.
Boric oxide and acid	r8,689	13,606	10,634	France 1,711; U.S.S.R. 293; Italy 253.
Cement	256,721	248,421	211,652	Japan 35,315; Belgium-Luxembourg 432.
Clays and clay products including all refractory brick:				
Crude:				
Bentonite	r353,790	612,746	423,902	Greece 188,772.
Fire clay	r34,876	52,244	52,237	Belgium-Luxembourg 7.
Fuller's earth	r823	1,483	1,483	
Kaolin (china clay)	r181,887	273,422	231,245	United Kingdom 42,156.
Other including refractory clay	r175,386	129,133	128,315	West Germany 453; United Kingdom 222.
Products:				
Refractory including nonclay bricks, value, thousands	r$59,172	$81,286	$74,606	United Kingdom $1,918.
Nonrefractory, do.	r$32,394	$43,530	$5,396	Italy $10,488; West Germany $4,966; Spain $4,239.
Cryolite, crude	r1,432	518	48	Denmark 452; Dominican Republic 18.
Diamond:				
Gem, not set or strung, carats	165,170	137,732	15,342	Belgium-Luxembourg 50,850; Israel 43,530; India 11,494.
Industrial, thousand carats	1,024	1,332	833	Ireland 375; France 32; Belgium-Luxembourg 24.
Dust and powder, do.	750	1,134	1,121	Belgium-Luxembourg 6; Ireland 6.
Diatomite	r25,373	28,347	28,347	
Fertilizer materials:				
Nitrogenous	r151,668	165,108	154,744	Chile 9,103; West Germany 968.
Phosphatic:				
Phosphate rock, thousand tons	r3,044	3,258	3,257	Netherlands Antilles 1.
Other	r286,743	381,751	379,711	Belgium-Luxembourg 1,320; Israel 697.
Potassic	r75,681	71,775	71,753	United Kingdom 20; West Germany 2.
Other including mixed	r96,404	132,857	132,650	Netherlands 131.
Ammonia	r54,919	56,227	56,227	
Fluorspar	r170,237	167,905	19,203	Mexico 105,862; Republic of South Africa 21,006.
Gypsum	70,995	152,463	18,154	Mexico 134,149.
Iodine	r175	260	18	Japan 242.
Lime	31,129	41,479	41,095	West Germany 304; France 80.
Magnesium:				
Dolomite, calcined	2,906	3,915	3,915	
Dead-burned or sintered	r62,003	84,931	58,514	Italy 14,130; West Germany 5,899; Switzerland 5,047.
Other	3,304	3,978	3,932	Australia 18; United Kingdom 18.
Mica, crude	r3,492	3,131	3,120	United Kingdom 11.
Pigments, mineral including processed iron oxides	r13,046	12,089	7,314	West Germany 2,586; France 842; Spain 722.
Precious and semiprecious stones, except diamond, value, thousands	r$12,060	$16,993	$6,086	Japan $1,488; Hong Kong $1,143; United Kingdom $1,129.
Salt and brines	r1,330	1,276	907	Mexico 340; Spain 22.
Sodium carbonate including sal soda	r177,633	183,220	183,078	Belgium-Luxembourg 90.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	r348,779	344,889	258,848	West Germany 61,706; Netherlands 12,333; Norway 7,990.
Caustic potash, and sodic and potassic peroxides	r5,440	3,888	3,506	France 144; Sweden 71.
Stone, sand and gravel:				
Stone:				
Dimension stone:				
Crude and partly worked	34,022	42,159	20,053	Republic of South Africa 15,174; Italy 5,878.

See footnotes at end of table.

Table 3.—Canada: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Stone —Continued				
Dimension stone —Continued				
Worked value, thousands	r$5,085	$5,446	$3,147	Italy $1,663; Republic of South Africa $328.
Limestone thousand tons	2,874	3,216	3,216	
Pumice and lava	11,468	37,848	20,024	Greece 17,742; Italy 72.
Quartz, silex and crystallized	1,954	1,259	1,241	United Kingdom 18.
Other including crushed and broken	66,239	86,131	83,782	Italy 2,059; United Kingdom 142.
Sand:				
Silica sand thousand tons	1,242	1,652	1,651	NA.
Other do.	r1,811	1,202	1,189	Belgium-Luxembourg 7; West Germany 5.
Sulfur:				
Elemental	8,130	1,699	1,687	West Germany 12.
Sulfuric acid, including oleum	107,765	170,618	131,292	West Germany 18,478; Mexico 7,457.
Talc, steatite, soapstone, pyrophyllite	r33,350	50,322	49,951	Italy 220; France 114.
Vermiculite, crude	r50,634	37,486	30,170	Republic of South Africa 7,316.
Other:				
Crude value, thousands	r$5,523	$10,310	$6,341	Madagascar $2,418; Republic of South Africa $696.
Oxides and hydroxides of magnesium, strontium, barium	28,904	38,405	37,813	United Kingdom 198; France 158.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s. value, thousands	r$6,500	$4,385	$3,010	United Kingdom $1,086.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural do.	r$2,873	$1,479	$1,344	West Germany $103.
Carbon black	r8,194	14,292	14,134	United Kingdom 77; West Germany 41.
Coal, all grades thousand tons	13,226	17,541	17,541	
Coke from coal do.	553	382	381	NA.
Fuel briquets of coal and coke	r9,698	45,888	45,805	West Germany 67; France 16.
Gas, natural million cubic feet	61	114	114	
Hydrogen and other rare gases	r55,924	60,405	58,866	Republic South Africa 1,128; France 332.
Petroleum:				
Crude thousand 42-gallon barrels	r231,172	222,529	47,330	Venezuela 74,884; Saudi Arabia 66,933; Iran 15,046.
Refinery products:				
Gasoline:				
Aviation do.	3	1	1	
Motor do.	r13	234	212	Netherlands Antilles 22.
Kerosine do.	6	3	2	Netherlands Antilles 1.
Jet fuel do.	336	163	55	United Kingdom 108.
Distillate fuel oil do.	242	815	39	Netherlands Antilles 413; Venezuela 362.
Residual fuel oil do.	r7,952	4,960	2,401	Venezuela 1,562; Netherland Antilles 997.
Lubricants including grease do.	r1,336	1,096	851	Trinidad and Tobago 238; United Kingdom 3.
Other:				
Liquefied petroleum gas do.	73	103	101	United Kingdom 1.
Naphtha do.	46	36	36	
Asphalt road oils do.	r81	231	193	Venezuela 38.
Petroleum and pitch coke do.	5,357	5,394	5,314	United Kingdom 80.
Petroleum jelly and wax do.	96	80	77	United Kingdom 1.
Unspecified do.	r787	783	745	West Germany 31; United Kingdom 4.
Total do.	r16,328	13,899		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r128,452	112,594	64,118	NA.

rRevised. NA Not available.

[1]May include relatively minor quantities of certain shapes not normally included among semimanufactures.

COMMODITY REVIEW

METALS

Exploration expenditures, which began to increase in 1978, continued to rise throughout 1980. All areas of the country benefited, and there was a particular resurgence in exploration work on known gold deposits and prospects. Also, capital investment in metal mining was exceptionally strong despite a sharp reduction in spending on iron ore. Many producers that had cut back on exploration during the late 1970's, in the face of stagnant prices and escalating production costs, resumed work in 1980 and in many cases took out options on adjacent properties.

The most intense development activity was in British Columbia, where projects costing almost $1 billion were underway or recently completed. In addition to new mines, these projects include expansion and modernization of processing facilities. By the end of 1981, the volume of potential copper production was expected to increase by almost one-third, and the increase in molybdenum mine capacity could be even larger. Sharp increases were also expected in production of gold and silver. A large silver mine began production in September 1980 at the Sam Goosly silver-copper property of Equity Silver Mines Ltd., near Houston, British Columbia. At full production, Equity is expected to be one of the major silver producers in Canada. Annual mine output has been estimated at 177,000 kilograms of silver, 6,400 tons of copper, and 1,700 tons of antimony.

In the Northwest Territories, construction started at a major zinc-lead mine in the High Arctic and at an important gold mine east of Great Bear Lake. In the Yukon Territory, there was activity in both gold and silver operations. Cyprus Anvil Mining Corp. was carrying out a $240 million expansion program at its lead-zinc-silver properties near Faro.

Silver and gold were also the focus of much activity in Ontario and Quebec. Ontario was again the leading silver-producing Province in Canada, with output in 1980 accounting for about 43% of the country's total production. At the Kid Creek property of Texasgulf Canada Ltd., work was continuing on the $140 million mine-mill expansion and the $280 million copper smelter and refinery complex. Both projects were scheduled to be completed in 1981. In Quebec, large development projects were underway at the Noranda and Grande Baie areas. Noranda Mines Ltd. announced a $35 million program that includes the construction of a 350- to 450-ton-per-day oxygen plant, and modifications to improve efficiency, working conditions, and environment through a reduction in dust emissions. Alcan Aluminum Ltd. completed the first stage of its $500 million aluminum smelter complex at Grande Baie with the startup of 26 pots (57,000 tons). Two additional potlines of the same size were planned for 1981 and 1982.

The Atlantic Provinces' metal mining industry will be further diversified when work on a new tungsten-molybdenum mine is completed. Construction of the Mount Pleasant tungsten-molybdenum mine, being developed under a joint venture between Brunswick Tin Mines Ltd. and Billiton Canada Ltd., is scheduled to begin production in early 1982. At its Lake George antimony mine, Consolidated Durham Mines & Resources Ltd. announced discovery of an extension of its ore body, which will significantly increase the life of the mine.

NONMETALS

In the asbestos industry, shipments of asbestos fiber in 1980 were lower than in 1979, as demand for all grades, particularly the shortest lengths, declined. Private negotiations between the Quebec Crown Corp., La Société Nationale de l'Amiante, and General Dynamics Corp. (GDC) of St. Louis, Mo., remained at an impasse over establishing a satisfactory purchase price. The Quebec Superior Court ruled in May 1980 that legislation designed to expropriate GDC's assets was constitutional. In the potash industry, prices during 1980 were very firm, particularly on the export markets. New production records and a total-revenue record of close to $1 billion were achieved. The Province of Saskatchewan is the largest exporter of potash in the world, and increased output is planned. The Potash Corp. of Saskatchewan controls about 40% of the industry.

Faced with high interest rates and an economic slump, the cement industry declined in 1980. Also, for the first time in many years, some plants stopped producing clinker for a number of weeks while inven-

tories were reduced. Sulfur output decreased about 16% from that of 1979, but Canada remained the world's largest exporter of sulfur. Gypsum production declined from the 1979 level, reflecting the slowdown in activity in the building industry.

MINERAL FUELS

In 1980, the Canadian coal industry received considerable attention from Governments, prospective customers, and producers. Production, consumption, and export of coal increased over those of 1979, and a number of new contracts were signed. In western Canada, several existing mines prepared to expand capacity, and new mines prepared for production. Provincial government institutions and universities increased their coal-related research on coal liquefaction, coal-oil mixture, new combustion processes, and other topics. Canadian forecasts predict the coal industry will increase output in both the domestic and the export sectors.

The record level of activity achieved by the petroleum industry in 1979 was surpassed in 1980. About 8,800 wells were completed to an aggregate depth of more than 11 million meters. This represents an increase of 1,200 wells completed and a depth increase of 2.3 million meters. The number of exploratory wells was expected to increase by some 60% because of greater activity in the Western Provinces and Ontario. In oil sand projects, the Alsands Project Group announced possible delays in its operation because of the lack of Provincial approvals. Expenditures for exploration and development were about $13.5 billion, some $3.0 billion more than in 1979.

Exports of crude oil and refined products in 1980 averaged 468,700 barrels per day, a decrease of 10% from 1979. Shipments to the United States of crude, refined products, and liquid petroleum gas amounted to 212,500 barrels per day and 137,500 barrels per day, respectively.

In Canada, uranium exploration and development activity remained high, with the focus on Saskatchewan, where one new facility commenced production, an important discovery was made, and two additional projects were in the planning stage. Important expansion programs continued in Ontario's Elliot Lake area, and new production projects were being considered in British Columbia and Newfoundland. The summary session of the Saskatchewan Key Lake Board of Inquiry was completed in October, and recommendations regarding the conditions under which the Key Lake Mine and mill development could proceed were expected in early 1981. Also of significance was the commencement, in Calgary, of Canada's first commercial recovery of uranium as a byproduct of the production of phosphoric acid.

Although several expansion projects proceeded on schedule in the Elliot Lake area of Ontario, a major fire destroyed the new mill facility of Denison Mines Ltd., located there. In Labrador (Newfoundland), development of the Kitts-Michelin project was deferred pending improved market conditions and further consideration of the environmental implications of the development. In British Columbia, the Provincial government imposed a 7-year moratorium on all uranium exploration and development activity.

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[1]For more detailed information on the mineral industry of Canada, see the Canadian Minerals Yearbooks for 1978 and 1979 and the Canadian Mineral Surveys for 1978 and 1979, both of which were prepared by the Mineral Development Sector, Department of Energy, Mines and Resources, Ottawa. The U.S. Department of the Interior, Bureau of Mines has arranged to have these Canadian publications placed in libraries in each of the 50 States and Puerto Rico as follows: University of Alabama, Tuscaloosa; E. E. Rasmuson Library, University of Alaska, Fairbanks; University of Arizona, Tuscon; University of Arkansas, Fayetteville; California State Library, Sacramento; A. Lakes Library, Colorado School of Mines, Golden; Wilbur Cross Library, University of Connecticut, Storrs; H.M. Morris Library, University of Delaware, Newark; Strozier Library, Florida State University, Tallahassee; P. Gilbert Memorial Library, Georgia Institute of Technology, Atlanta; University of Hawaii, Hilo; University of Idaho, Moscow; Morris Library, Southern Illinois University, Carbondale; Indiana University, Bloomington; Iowa State University of Science and Technology, Ames; Watson Library, University of Kansas, Lawrence; M. L. King Library, University of Kentucky, Lexington; University of Southwestern Louisiana, Lafayette; R. H. Fogler Library, University of Maine, Orono; Eisenhower Library, Johns Hopkins University, Baltimore, Md.; Massachusetts Institute of Technology Library, Houghton; Wilson Library, University of Minnesota, Minneapolis; University of Southern Mississippi, Hattiesburg; Rolla Library, University of Missouri, Rolla; Montana College of Mineral Science and Technology, Butte; D. L. Love Library, Nebraska Geological Survey at University of Nebraska, Lincoln; University of Nevada, Reno; University of New Hampshire, Durham; J. C. Dana Library, Rutgers University, Newark, N.J.; New Mexico Institute of Mining and Technology, Socorro; Columbia University, New York, N.Y.; D. H. Hill Library, North Carolina State University, Raleigh; Frity Library, University of North Dakota, Grand Forks; Ohio State University, Columbus; University of Oklahoma, Norman; Multnomah County Library, Portland, Oreg.; Pennsylvania State University, University Park; University of Rhode Island, Kingston; University of South Carolina Undergraduate Library, The Horseshoe, Columbia; South Dakota School of Mines and Technology, Rapid City; Tennessee State Library and Archives, Nashville; Main Library University of Texas, Austin; Marriott Library, University of Utah, Salt Lake City; Bailey Library, University of Vermont, Burlington; Virginia Polytechnic Institute, Blacksburg; University of Washington, Seattle; West Virginia University, Morgantown; Memorial Library, University of Wisconsin, Madison; University of Wyoming, Laramie; and University of Puerto Rico, Mayaguez.

[2]Supervisory physical scientist, Branch of Foreign Data.

[3]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars at the rate of Can$1.17=US$1.00, the average exchange rate for the year.

Does not include the value of uranium production, which is not available.

The Mineral Industry of Chile

By Pablo Velasco[1]

In 1980, Chile maintained its position as the second largest market economy producer of copper after the United States. Chile has the largest share of the world's known and probable copper reserves, estimated at 97.0 million tons or 20%. It also ranks second in output of molybdenum with 24% of the world's reserves after the United States and third in iodine production after the United States and Japan. In addition, Chile is a significant producer of vanadium, rhenium, selenium, and lithium. According to Chile's Oficina de Planificación Nacional (ODEPLAN), the real gross domestic product (GDP)[2] continued to expand, increasing to 6.5% in 1980, compared with the 5.3% average for Latin America and the 1.5% average growth of developed countries. Measured in 1977 dollars, the GDP grew from $15.6 billion in 1979 to $16.7 billion in 1980. Inflation declined to 31% in 1980. Exports of $4.8 billion represented an increase of 28% over the previous year's value. The relative importance of copper, Chile's major export, has been declining as a percentage of the total exports, dropping to 46% in 1980 compared with 82% in 1973, indicating diversification of the export sector.

Revenues from the mining sector, mainly copper, will continue to be the country's single most important long-term source of foreign exchange earnings. Mining sector revenues are expected to steadily decline as new forms of export production enter the scene.

Since the enactment of Chile's Foreign Investment Law in July of 1974, 655 individual investment projects have been authorized, and 554 projects entailing $4.1 billion in direct foreign investment are still in planning or have already materialized. American interests account for 151 of these projects representing 83.3% of the authorized total value. Only 23 of the 554 projects involve the mining sector. Investment in three copper projects, The Anaconda Company in Los Pelambres, Exxon Minerals Corp. in Disputada de Las Condes, and Falconbridge Nickel Mines Ltd. in Quebrada Blanca, is estimated to total $3.2 billion. There are currently 12 prospecting projects being carried out by 15 foreign companies, which are exploring for copper, gold, zinc, lead, barite, coal, silver, and tin. Although the amount of capital invested is small, these projects could open future opportunities for large-scale mining.

As of the end of 1980, firms representing 40 different countries had either made direct investments or had them pending. The largest investor was the United States, with almost $3.3 billion or 80.0% of the approved total, followed by Canada with $259.9 million or 6.4%; Panama, 2.9%; Great Britain, 2.6%; the Federal Republic of Germany, 1.8%; and Japan, 1.4%.

A disappointing development in the mining sector in 1980 was Noranda Mines Ltd.'s decision not to go ahead with the Andocollo project. This decision cut potential investment by $400 million and made it unlikely that Chilean annual copper production will exceed 1.5 million metric tons during this decade.

Government Policies and Programs.—The Chilean Government still exercises widespread control over the mining industry through the State copper mining company, Corporación Nacional del Cobre de Chile (CODELCO-Chile), and the State industrial holding company, Corporación de Fomento de la Producción (CORFO), which controls various relatively small enterprises. Six large State-owned enterprises dominate the Chile mineral industries: (1) CODELCO produces 85% of the country's copper; (2) Empresa Nacional de Minería (ENAMI) manages a number of medium- and small-

size mines and smelters; (3) Cía. de Acero del Pacífico S.A. (CAP) operates the country's largest iron ore mines and its only major steel refinery; (4) Empresa Nacional del Carbón S.A. (ENACAR) is the main producer of coal in Chile; (5) Empresa Nacional del Petróleo (ENAP) controls all exploration and production of oil and natural gas; and (6) Sociedad Química y Minera de Chile (SOQUIMICH), the parent organization of all of Chile's significant nitrate mines and refineries, also produces iodine, lithium, sodium, and potassium sulfate.

The economic policies currently in effect in Chile have encouraged development of the private sector economy. Direct private foreign investment is of central importance to current Government economic policy and plans. Accordingly, regulations have been streamlined and liberalized, and foreign and domestic investments have been placed on a more equal footing. Except for those sectors already occupied by State corporation monopolies, foreign investment is permissible and welcome. Foreign investors are waiting for the final wording of the new mining code, which is expected to be announced in June or July 1981.

In the minerals field, the State remains the principal producer, and the country's new constitution specifically exempts mineral resources from normal private property rights, reserving the country's mineral wealth as the exclusive patrimony of the State. The constitution, however, does envision a mineral concession regime for private sector mineral exploitation. This is to be defined in the new mining code. A draft has been submitted to the President. The new mining code will not cover lithium, petroleum, rhenium, thorium, or uranium, which are already governed by special regulations.[3]

PRODUCTION

Copper production stayed close to the 1979 level. Production rose from 1,060,600 metric tons in 1979 to 1,067,700 metric tons in 1980, although blister copper production declined by 17%. CODELCO-Chile is the principal producer, and the private sector currently accounts for some 200,000 metric tons per year. Owing to El Indio, St. Joe Mineral Corp.'s copper mine, gold production jumped 100% in 1980 and should increase in 1981. El Indio will also produce copper and silver. Production declined in iron, zinc, barite, sodium nitrate, salts, and marble, but increased in all other mineral products. Production of molybdenum in 1980 rose to 13,668 metric tons of fine molybdenite and 100.5 metric tons of metal doré.

Chile produces vanadium from magnetite iron ore as a byproduct from the slag from the steel production. Iron ore production increased 12% to 8.6 million metric tons compared with that of 1979, while steel production increased 8% to 695,000 metric tons compared with 1979 output. Domestic consumption reached 72% of the total output, and the remainder was exported.

Molybdenos y Metales S.A. (Molymet) began extracting rhenium in the later half of 1980, and CODELCO now markets rhenium as an individual product. Production was 80 to 100 kilograms per month. Selenium production at Chuquicamata and ENAMI's refinery accounted for 17,000 kilograms in 1980, of which 9,600 kilograms were exported to the United States. Cement production increased 14% to 1.8 million metric tons compared with 1979 output. Coal production declined 19% to 778,000 metric tons in 1980 compared with 1979 output. Crude petroleum output increased 58% to 12 million gallons in 1980 compared with 1979 production.

Chile's largest worker strike since the 1973 military coup continued at El Teniente copper mine as more than 10,000 mine workers stayed away from their jobs. The strike, which began midnight April 21 and continued to the middle of July 1981, involved eight mine workers' unions protesting poor wages. Government officials estimated that the work stoppage is costing $1 million per day and has cut mine production by about 25%. Under current labor laws drafted by the military in 1979, Government-owned companies could begin hiring temporary workers after 30 days and could permanently replace striking workers after 59 days. Record copper production during the first quarter should limit the strike's effect on supplies or price.

Table 1.—Chile: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Copper:					
Mine output, metal content[3]	1,005,200	1,056,200	1,035,500	1,060,600	1,067,700
Metal:					
Smelter, primary[4]	856,300	888,400	927,400	946,900	953,100
Refined:[5]					
Fire, primary refined	141,700	144,400	151,900	161,800	147,100
Electrolytic	490,300	531,600	597,200	617,700	663,600
Total	632,000	676,000	749,100	779,500	810,700
Gold, mine output, metal content—troy ounces	129,172	116,376	102,287	111,405	219,773
Iron and steel:					
Ore and concentrate:					
Gross weight—thousand tons	r9,723	r7,656	7,042	7,526	8,587
Iron content[e]—do	5,931	4,670	4,336	4,634	5,287
Pig iron—do	403	432	539	611	644
Ferroalloys:					
Ferromanganese	8,301	4,267	5,853	5,221	5,200
Silicomanganese	1,550	283	132	256	300
Ferrosilicon	4,480	3,168	2,173	5,063	5,000
Other	685	886	66	892	1,000
Total	15,016	8,604	8,224	11,432	11,500
Crude steel[6]—thousand tons	480	548	598	657	712
Semimanufactures (hot-rolled)	324	395	446	503	572
Lead, mine output, metal content	r206	r116	431	252	461
Manganese ore and concentrate	r26,639	18,001	23,243	24,969	27,701
Mercury—76-pound flasks	13	20	--	--	--
Molybdenum, mine output, metal content	10,899	r10,937	13,196	13,560	13,668
Selenium—kilograms	15,041	8,297	8,165	28,290	17,100
Silver—thousand troy ounces	7,342	8,461	8,210	8,740	9,598
Vanadium, mine output, metal content[e 7]	r1,090	860	r690	r450	360
Zinc, mine output, metal content	r5,053	3,918	1,814	1,847	1,830
NONMETALS					
Barite	21,243	65,038	182,422	226,767	225,529
Borates, crude, natural (ulexite)	3,432	4,248	26,544	3,049	3,275
Cement, hydraulic—thousand tons	r963	r1,123	1,177	1,353	1,584
Clays:					
Kaolin	66,735	55,712	48,117	59,222	59,425
Other (unspecified)	44,079	77,086	80,986	129,829	158,391
Diatomite	330	480	5,008	763	1,147
Feldspar	823	2,452	903	133	2,150
Gypsum:					
Crude	65,079	r147,104	174,143	162,482	198,115
Calcined	56,843	56,447	48,601	54,917	74,435
Iodine, elemental	1,423	1,856	1,922	2,410	2,601
Lime, hydraulic[e]—thousand tons	600	620	620	635	635
Nitrogen: Natural crude nitrates:					
Sodium	491,415	482,110	422,975	467,200	440,000
Potassium enriched	127,565	81,160	106,670	154,100	180,000
Phosphates: Guano	16,107	7,017	240	--	--
Pigments, mineral, natural: Iron oxide	6,941	8,146	5,263	2,590	4,451
Potash, K_2O equivalent	14,859	e16,000	e17,000	15,000	15,000
Pumice (includes pozzolan)	98,681	r158,928	r182,626	220,088	249,805
Quartz, common	158,195	169,771	194,443	141,079	e165,000
Salt, all types	427,766	424,165	393,499	589,845	441,105
Sodium compounds:					
Sodium carbonate[e]	9,000	9,900	10,800	10,800	10,800
Sodium sulfate[8]	42,891	44,358	45,783	69,000	71,315
Stone:					
Limestone—thousand tons	r1,794	r1,918	2,188	2,300	2,766
Marble	423	1,413	7,552	3,882	2,505
Sulfur:					
Native, other than Frasch:					
Refined	16,334	4,967	13,520	11,605	13,925
Caliche	1,428	26,942	18,109	65,290	73,510
Byproduct (from industrial gases)	30,079	28,662	20,709	27,287	e26,700
Total	47,841	60,571	52,338	104,182	114,135
Talc	1,109	427	432	850	1,139

See footnotes at end of table.

Table 1.—Chile: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous and lignite thousand tons	1,300	1,342	1,148	957	778
Coke:					
Coke oven do	214	e215	e215	e190	NA
Gashouse[e] do	5	5	5	5	NA
Gas, natural:					
Gross million cubic feet	248,318	237,273	217,776	250,000	e240,000
Marketed do	141,858	133,857	123,588	138,094	e135,000
Natural gas liquids:					
Condensate thousand 42-gallon barrels	686	746	656	674	e650
Natural gasoline do	918	1,020	920	1,200	e1,150
Liquefied petroleum gas do	2,887	2,971	3,076	2,971	e2,800
Total do	4,491	4,737	4,652	4,845	e4,600
Petroleum:					
Crude do	8,371	7,119	6,281	7,561	e7,000
Refinery products:					
Gasoline:					
Aviation do	75	98	106	129	e130
Motor do	8,091	7,880	8,488	8,755	e8,800
Jet fuel do	937	1,080	1,082	1,282	e1,300
Kerosine do	2,843	2,666	2,670	2,681	e2,700
Distillate fuel oil do	6,386	6,535	6,736	7,411	e7,500
Residual fuel oil do	7,712	9,315	10,182	11,188	e11,200
Other:					
Liquefied petroleum gas do	(9)	2,506	2,616	e2,700	e2,700
Unspecified do	5,286	1,268	1,558	e1,500	e1,500
Refinery fuel and losses do	1,251	1,233	1,233	r e1,300	e1,400
Total do	32,581	32,581	34,671	36,946	e37,230

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 15, 1981.

[2]In addition to the commodities listed, pyrite is also produced, but available information is inadequate to make reliable estimates of output levels.

[3]Figures are the nonduplicative copper content of ores, concentrates, precipitate, metal, and other copper-bearing products measured at the last stage of processing as reported in available sources.

[4]Figures are total blister and equivalent copper output including that blister subsequently refined in Chile and copper produced by electrowinning.

[5]Figures are total refined copper distributed into two classes according to method of refining.

[6]Excludes castings.

[7]Estimated on the basis of reported vanadium content of vanadiferous slags imported by the United States from Chile.

[8]Includes natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry.

[9]Included in "Unspecified."

TRADE

Chile's current account balance of payments has been in deficit for several years. In 1980, the current account deficit was $1.6 billion; the increase over that of 1979, much more than $400 million, was attributable to rapidly rising consumer good imports. The Central Bank of Chile projects the current account deficit to rise to $2.24 billion in 1981. The 1980 foreign trade figures continued to reflect the upward trend evident since 1975. Exports reached $4.82 billion, up 28.0% over 1979 value. Exports from every sector of the economy increased, especially those from the nontraditional mining and traditional industrial areas. Imports reached $5.82 billion compared with $4.2 billion in 1979, a growth rate of 38.0%. Although the 33.3% rise in the combined total of Chile's international trade reflected a slowdown over the nominal rate of growth experience in 1979, combined export and import trade with the United States grew more than twice as rapidly as in 1979 and accounted for 20.4% of Chile's total merchandise trade.

The share of copper in total value exports

declined from about 82.2% in 1973 to 45.7% in 1980. In value terms, copper exports increased 22.3%, partly as a result of world prices rising 10%. The value of other traditional exports (iron ore, nitrates, iodine, molybdenum, etc.) increased 32.8%. Major items contributing to this favorable performance were nontraditional minerals, which as a class rose 164.3% in value to $243 million, including a $102.6 million increase in precious metals.

In the mining sector, the volatile, now weak, copper price is the key determinant of the nominal value of exports. Pending investment projects, however, demonstrate the potential for enormous increases in mineral exports later in the decade. As an economic category, imports have probably been the most affected by Chile's free market policy, owing to the reduction to 10% of its tariff barriers. In spite of the increase in international oil prices, crude oil imports increased only $3.5 million, from $811.2 million to $814.7 million. The 60.4% increase in domestic production permitted a 20.7% reduction in volume of imported crude oil. Foreign trade was maintained with more than 105 countries; over 3,000 products were exported. The principal countries importing Chilean goods were the Federal Republic of Germany (12.3%), the United States (12.2%), Japan (10.4%), and Brazil (9.3%). Fording Coal Ltd. of Calgary, Canada, has agreed to supply CAP, the Chilean State-owned steelmaker, with 1.5 million metric tons of metallurgical coal over the next 8 years. The shipments will begin this year. Fording's contract is said to be worth in excess of $2.6 million in 1981 terms. Fording is 60% owned by Canadian Pacific Enterprises Ltd. and 40% by Vancouver's Cominco Ltd.

Chile's high rate of unemployment is declining. Higher oil prices are also part of the Chile economic problem. Moreover, Chile is fortunate in that the cost of petroleum imports represents a less serious resource drain. Petroleum consumption rose less than 1% during 1980. In addition, petroleum self-sufficiency averaged 36.3% of consumption, up from 24% in 1979, thus limiting oil imports to $814.7 million, a negligible 0.4% increase, despite a 31% rise in unit value.

Copper production maintained its 1979 level, approximately 1.07 million metric tons, while average sale prices rose 10.4%. Output of molybdenum, gold, silver, and other minerals increased considerably because of new investments and higher international prices. In the energy field, oil production increased by 60.4%, while that of natural gas production decreased slightly. Coal production declined 18.7% as a result of the streamlining of operation by ENACAR. In 1980, Empresa Nacional de Electricidad, S.A. (ENDESA), continued development of the 300-megawatt Antuco hydroelectric plant and the Colbún Machicura 490-megawatt first-stage plant, which is scheduled to come online in 1985.

Copper remains the major Chilean export by far, but has been declining as a percentage of the total. The value of other traditional exports (iron ore, nitrates, iodine, and molybdenum) increased 32.8%.

Table 2.—Chile: Value of principal mineral exports

(Million U.S. dollars)

	1978	1979	1980	Variation 1979-80		
				Value of variation	Percentage variation	
					From 1979	Of total 1980
Copper	1,201.5	1,799.6	2,200.4	400.8	22.3	45.7
Iron	79.6	110.4	157.6	47.2	42.8	3.3
Nitrates and iodine	46.8	58.4	89.2	30.8	52.7	1.9
Molybdenum	47.3	193.5	229.0	35.5	18.3	4.8
Total principal mineral exports	1,375.2	2,161.9	2,676.2	514.3	23.8	55.6
Total value of all exports	2,407.8	3,763.4	4,818.1	1,054.7	28.0	100.0

Source: Indicadores de Comercio Exterior Central Bank.

COMMODITY REVIEW

METALS

Copper.—The production of copper in Chile in 1980 rose to 1.07 million tons compared with 1.06 million in 1979, a 1.0% increase. The large-scale mines showed a 0.6% decrease in production between 1979 and 1980. The medium- and small-scale mines, on the contrary, showed a 11.5% increase in production in the same period. Chile's copper output during 1981 is expected to rise to 1.08 million tons, according to the country's officials. The increase will result from production at Las Cascadas and Manto Verde Mines of Pudahuel Mining Co., El Indio, and Mantos Blanco's new expansion, as all three mines have recently come onstream. CODELCO-Chile, which accounts for 84% of the country's total output, reported earnings of $401 million in 1980 compared with $467 million for 1979.

In 1980, CODELCO-Chile produced 904,513 tons of fine copper. The Chuquicamata Div. produced 56.5% of the total, El Teniente 29.4%, El Salvador 8.3%, and Andina 5.8%.[4] CODELCO-Chile recently announced a capital investment program of $1.84 billion for the next 5 years, compared with $1.04 billion between 1974-80. This expenditure is to be divided among the four divisions of the company (Chuquicamata, El Teniente, Andina, and El Salvador) for the expansion of ore treatment capacity and maintenance of current production, administrative, and other projects. Present production level maintenance will receive the most part of the investment owing to the declining copper content of mined ore, which now averages 1.7% but is being forecast to fall to 1.0% in the next 25 years. CODELCO-Chile expects to maintain production at an average of 940,000 tons of fine copper per year for the next 5 years.

Another problem that these investments are expected to overcome is the increasing hardness of the mined ore. Emphasis is being placed on an energy-saving technology that will allow production at lower costs, on the substitution of alternative fuels for petroleum, and on environmental control.

Chuquicamata's investments planned for the next 5 years amount to $877 million distributed as follows: 1981 primary crushing plant ($68.3 million), new tailings dam construction (first stage, $18.4 million), development of the first phase of a smelter ($45.5 million), the Tocopilla Generating Unit No. 12, ($46.6 million), and the conversion of Tocopilla energy production from petroleum to coal ($80.6 million). These investments are expected in the near future because of the decline in copper content of mined ore from the present 2.21% to 1.66% in 1985. Production levels are expected to be maintained at 510,000 tons of fine copper each year throughout the 1980's.

El Teniente, producing 260,000 tons of fine copper per year, is expected to have an investment of at least $734 million to maintain the same production through 1986. As the copper content of the ore decreases to 1.44% from the current 1.54% and being faced with harder ore, CODELCO-Chile is studying the feasibility of increasing production from 62,000 to 80,000 tons per day by 1986, and to 110,000 tons by 1990. The most important investments to be made by 1985 are as follows: Construction of infrastructure to mine areas that contain about 220 million tons of reserves ($36.1 million); purchase and installation of new equipment to develop, mine, and transport the ore from these new areas ($14 million); construction of new infrastructure and purchase of new equipment for processing ore extracted from the primary crushing plant at level Teniente 6 with a capacity of 25,000 tons per day ($31.7 million); the continuation of the Colihues dam project for tailings discharge ($24 million); and the construction of a new ore processing plant located at Barahona ($216 million). At Andina, which has a copper content that is expected to remain at 1.2% over the next 5 years, an investment of $99 million is planned to stabilize copper production at the current 53,000 tons of fine copper per year through 1985. The most important investments to be made are the expansion of production capacity of the mine and processing plant from 14,000 to 20,000 tons of ore per day ($43 million), construction of new infrastructure for the exploitation of the second production level ($13.6 million), and the construction of Los Leones tailings dam ($13.7 million).

El Salvador investments planned are expected to reach $130 million, maintaining production at the current 77,000 tons of fine copper per year through 1985, with a copper content of the ore decreasing to 0.99% from the present 1.22%. The investments planned for this mine are 30% expansion in ore

processing plant capacity ($18.5 million), of which $12 million is programed between 1980 to 1985. Foreign companies have also stepped up investment in Chilean copper deposits that are expected to be brought onstream in the mid-1980's. Exxon Minerals Co. in Disputada de Las Condes, The Anaconda Company in Los Pelambres, and Falconbridge Nickel Mines in Quebrada Blanca, have all made sizable investments for exploratory studies and construction of ancillary facilities.

Another mine, Lo Aguirre owned by the Chilean firm Sociedad Minera Pudahuel S.A., began operations in 1980. It is expected to produce 17,000 tons of copper per year. Lo Aguirre is not the only venture of Sociedad Minera Pudahuel. Last July the company acquired the Sagasca Mines for $37 million (previously owned by Continental Copper Corp.). The Sagasca operation was renamed Las Cascadas and is expected to produce 23,000 metric tons per year of copper concentrate. In addition, Minera Pudahuel bought a 50% interest in Compañía Minera Manto Verde, a Chilean-owned copper deposit. A $60 million investment to develop this copper oxide ore body near Chañaral is now under way. This operation could also produce 50,000 pounds per year of uranium oxide (yellow cake). It was reported that Minera Pudahuel is negotiating with the U.S. firm AMAX Inc. for the purpose of a joint venture grass-roots, base-metal exploration effort. A disappointing development in the mining sector in 1980 was Noranda's decision not to go ahead with the Andacollo copper project. That decision has reduced the potential investment in mining by $400 million and cut deeply into plans for future national production levels. There is a good possibility that Andacollo will be offered for sale to the private sector sometime after the issuance of the new mining code. Chilean companies have bought 55% of the shares in the El Toqui mining company from the West German Metallgesellschaft group. El Toqui is spending $17 million to develop its Aisen Mine in southern Chile, where ore reserves amount to more than 800 million metric tons of 2.5% copper, 13% zinc, and 0.22 ounce of gold per metric ton.

Table 3.—Chile: Copper production, by sector and company

(Thousand metric tons of fine copper)

	1976	1977	1978	1979	1980
LARGE MINES (CODELCO)					
Chuquicamata	445.5	r477.8	500.7	507.2	510.9
El Salvador	82.7	r80.7	77.5	78.1	74.8
El Teniente	261.7	r275.7	250.6	278.2	266.0
Andina	56.9	r58.5	47.7	46.7	52.8
Total	846.8	892.7	876.5	910.2	904.5
MEDIUM AND SMALL MINES					
Mantos Blancos	30.1	28.5	38.2	36.0	29.7
Empresa Nacional de Minería (ENAMI)	74.3	80.6	77.0	82.4	102.8
Disputada de Las Condes	35.7	36.1	28.8	20.9	28.6
Other	18.3	18.3	15.0	11.5	2.1
Total	158.4	163.5	159.0	150.8	163.2
Grand total	1,005.2	1,056.2	1,035.5	1,061.0	1,067.7

rRevised.

Source: Comisión Chilena del Cobre.

Table 4.—Chile: CODELCO-Chile copper output, by product

(Metric tons of fine copper)

Product	1976	1977	1978	1979	1980
Electrolytic	382,096	422,116	460,852	477,814	505,873
Fire-refined	116,686	120,742	117,265	131,706	121,022
Blister	172,599	150,795	134,227	139,368	115,321
Concentrate	182,711	199,059	164,151	161,311	162,297
Total	854,092	892,712	876,495	910,199	904,513

Source: CODELCO-Chile. Chilean National Copper Corp., 1980 profile booklet.

Iron Ore.—During 1980, CAP decreased its shipments from the higher tonnages of the past 2 years to a total (iron ore and pellet) of 8.6 million metric tons, of which 3.2 million tons were pellets.

CAP iron mines are located in the Copiapó, Vallenar, and Coquimbo zones of northern Chile and currently have an iron ore capacity of some 11.0 million metric tons per year. The production from these mines is exported to other countries and is consumed in Chile, principally at CAP Huachipato steel plant in Region VIII (Concepción) in the south. CAP's major source of iron ore comes from the Santa Fé, Algarrobo, and El Romeral Mines.

Chile has 900 million metric tons of proven iron ore reserves and an additional 2 billion metric tons of probable reserves with 62% average iron content. The ore contains substantial sulfur and phosphorous impurities.

Iron ore is shipped from CAP's own mines, principally from the El Romeral Mine (which formerly belonged to Bethlehem Steel Corp.) but also from CAP's new pellet plant at Huasco. Around 1 million metric tons per year of this is shipped to the Huachipato steel plant, and the remainder (about one-third of which is pellet) is shipped to export markets in Japan, the United States, Argentina, and Europe. There are plans to expand raw materials unloading and handling facilities at the plants. Investments on the order of $60 million are expected by 1983. Projected appropriations include $15 to $20 million in the El Romeral Mine, $7 to $10 million in Los Colorados Mine, and $30 million for new technology.[5]

Iron and Steel.—The 35-year-old CAP, Chile's principal steel producer, owns the Huachipato steel plant and the Huasco pellet plant. The steel plant has two blast furnaces with 750,000 metric tons per year raw steel capacity, which will be increased to 1.1 million metric tons per year by 1984. The pellet plant has a capacity of 3.5 million metric tons per year of self-fluxed pellets. Plans are to expand the complex to 3.8 or 3.9 million metric tons per year by 1983 using an energy-saving Allis Chalmers heat recovery system that uses coal instead of oil and exchanges lime hydrate for cheaper varieties. CAP was transformed into a holding company divided into seven wholly owned subsidiaries. These companies will each be completely independent. These seven subsidiaries include three that had already been created plus four new ones. The three older divisions are Compañía de Acero de Rengo, which operates the smaller Rengo steel plant in Region VI (Rancagua); Manganesos Atacama S.A., producer of ferrous manganese; and Pacific Ores and Trading Co., marketer of CAP's iron ore and pellet production. The two largest subsidiaries of the four new divisions are Sociedad Anónima Siderúrgica, which produces steel at the Huachipato plant in Region VIII (Concepción), and Sociedad Anónima Minera, which mines iron ore and operates the Huasco pellet plant in Region III (Copiapó). The other two are Sociedad Anónima Commercial, which will market steel output, and Sociedad Anónima Abastecedora, which will act as purchasing agent, on a commission basis, for the other divisions. The Huachipato work's location is very favorable from the point of view of raw material supplies. It is only 30 to 40 kilometers from Chile's largest coal reserves—the Lota and Schwager Mines in the Arauco coalfields, which provide 60% of the work's needs. The remainder comes from the United States.

Manganese.—Manganese mining in Chile dates back to the turn of the century. Current production is approximately 28,000 metric tons per year in concentrates, basically from one small enterprise, Manganesos Atacama S.A. The primary use of the manganese produced is in domestic steel production. No significant changes in the current level of production are foreseen. In 1979, Manganesos Atacama's plant at Guayacán processed 11,500 metric tons of ore and obtained 4,593 metric tons of ferromanganese and 102 metric tons of manganese dioxide. Production of manganese mainly

from Atacama, in northern Chile, increased 10% in 1980 while the average grade dropped from 34.5% to 32.6%.

Molybdenum.—During 1980, molybdenum production reached 13,668 metric tons, slightly higher than the 13,559 metric tons produced in 1979. CODELCO-Chile is the only producer of molybdenum in the country and continues to be the third largest producer in the world. CODELCO's molybdenum production sources are distributed as follows: Chuquicamata Div. was responsible for 68% of total molybdenum production; El Teniente Div., 17%; El Salvador Div., 10%; and Andina Div., 5%. Molybdenum shipments for 1980 totaled 14,841 metric tons, a 24% increase compared with that of 1979, valued at $331.4 million, a decrease in value from the $334.2 million registered in 1979. The molybdenum shipments increased 30.4%, but the product yielded lower returns because the price of molybdenum dropped sharply. By contrast, the metal doré and other byproducts showed an increase both in prices and shipments, which resulted in higher income amounting to $32.5 million. CODELCO's El Salvador Div. is concentrating its efforts on molybdenum as its copper ore grade declines. In the future, however, new producers may emerge, since there is significant molybdenum potential in at least three of the new projects planned for the near future—Los Pelambres (Anaconda), Quebrada Blanca (Falconbridge and Superior), and Andacollo (formerly Noranda). According to Chilean sources, molybdenum byproducts from CODELCO's copper mines are decreasing steadily, and copper ore grades will force a sharp downturn in molybdenum production between now and 1985. CODELCO is building a 6,000-metric-ton-per-year molybdenum roaster at Chuquicamata, which will be ready for startup by mid-1982 and will process all of CODELCO's molybdenum output. CODELCO currently has a toll conversion contract with Molymet in Chile where about 42% of its production is processed, and the remaining concentrates are sent abroad for processing.

Table 5.—Chile: CODELCO-Chile output of byproducts

(Metric tons)

Byproduct	1976	1977	1978	1979	1980
Fine molybdenum contained	10,899	10,937	13,196	13,559	13,650
Metal doré	92.1	113.1	106.3	99.3	100.5

Source: CODELCO-Chile. Chilean National Copper Corp., 1980 profile booklet.

Precious Metals.—Chile's gold and silver production comes not only from gold mines but also as byproducts of copper mining and refining. The spectacular production of gold in 1980 at El Indio Mine by Cía. Minera San José, a subsidiary of St. Joe Minerals Corp. of the United States, coincided with a period of record gold prices.

During 1980, high-grade ore (11.5 ounces of gold and 4.6 ounces of silver per metric ton, and 2.63% copper) from St. Joe's El Indio Mine, containing approximately 93,000 troy ounces of gold was shipped directly to ASARCO Incorporated in the United States, Norddeutsche Affinerie in the Federal Republic of Germany, and Société Générale des Minerais in Belgium without further processing at the mine. Profits from this mine were exceptionally high because of the selective mining of high-grade ore. Development of the mine and mill complex will proceed toward its schedule to startup in the third quarter of 1981. Meanwhile, a shipment of gold-bearing ore, which requires no processing at the mine, will continue. The shipments are expected to contain in excess of 100,000 troy ounces of gold. Proven reserves at yearend 1980 were sufficient to permit more than 1 year of gold-bearing ore shipments. El Indio mill will have an estimated daily capacity of 1,400 tons of ore. In 1982, the operation should yield over 175,000 troy ounces of gold, 1.5 million troy ounces of silver, and 13,000 tons of copper. St. Joe intends to form ventures with other international mining companies, as well as Chileans, to explore and possibly develop other prospects. In December 1980, St. Joe reached an agreement with Preussag A.G. of the Federal Republic of Germany and Chilean companies Empresa Pesquera Eperva S.A. and Pesquera Indio S.A. to form the first of these ventures. After final agreements are reached, this group will proceed with drilling and underground exploration to

evaluate further the Sancarrón prospect, which is located about 12 kilometers north of El Indio. St. Joe, Preussag, and the Chilean companies will each hold a 20.95% interest in the venture, and the remainder will be held by other private investors.

CODELCO produces gold as a byproduct of copper metal doré and anode slimes. Production in 1980 was 26,500 troy ounces compared with 24,400 troy ounces in 1979. Chile's total gold production in 1980 was 219,773 troy ounces, an increase of 97% over that of 1979.

Uranium.—According to Decree Law 2886 of November 1979, the responsibility for development, exploration, exploitation, and processing of natural radioactive minerals falls under the Comisión Chilena de Energía Nuclear (CCEN). Uranium is not mined anywhere in the country, although prospecting is carried out, particularly in northern Chile. In view of the availability of coal, oil, and hydroelectric power, nuclear energy is unlikely to form a major source of power for Chile in the foreseeable future. However, as part of the CCEN energy development program, a 600-megawatt nuclear powerplant is under study with assistance of the Empresa Nacional de Electricidad S.A. and Compañía Chilena de Electricidad. Chile is planning a uranium recovery plant for its Chuquicamata copper mine. Production is being estimated at 40 to 60 tons per year of uranium oxide. CCEN is waiting for permission from Chuquicamata before building the plant.

A spokesperson for Minera Pudahuel said that the new Las Cascadas copper mine in Chile will start production of uranium oxide at the rate of 50,000 pounds per year. The Las Cascadas Mine has an annual output capacity of 23,000 metric tons of copper per year and was purchased 3 months ago by its owners from Empresa Sagasca for $37 million.

NONMETALS

Cement.—Chile's cement production in 1980 rose 14% to 1.6 million metric tons compared with 1.4 million metric tons in 1979, of which 96% was domestically consumed leaving only 4% for export mainly to Bolivia and Ecuador. There are four cement plants in Chile: The British-owned Fábrica de Cemento El Melón S.A., a subsidiary of Blue Circle Industries Ltd.; Cemento Cerro Blanco de Polpaico S.A. plant, in which the main shareholder is Holderbank of Switzerland; Cementos Bio-Bio S.A., Chilean owned; and Industria Nacional de Cemento S.A., 82% owned by Blue Circle Industries Ltd. and 18% private. The first two plants are in the process of doubling their capacity by 1983 to 1.3 million metric tons per year to meet the rising demand for cement by housing and industrial expansion and the Colbún hydroelectric project. Cement export will be either minimal or nonexistent for a long time to come.

Iodine.—Chile maintained its position as the third largest iodine producer in the market economy countries after the United States and Japan. Iodine production in Chile is tied to nitrate production (although income from iodine is now as large as income from nitrates). Iodine output in 1980 increased 8% to 2,600 metric tons over 1979 production. SOQUIMICH has exclusive rights to mine nitrates and their byproducts in the country (mainly in the desert areas in northern Chile). In November 1979, SOQUIMICH closed its Victoria Mine in Region I (Arica and Iquique Provinces) and reduced its activities to the Pedro de Valdivia and María Elena Mines in Region II (Tocopilla, Antofagasta, and El Loa Provinces) and the new iodine plant Coya Sur located at María Elena. The new technology and plants being installed and designed by Saline Processors, a U.S. consulting firm, will also help reduce the SOQUIMICH deficit. SOQUIMICH will begin production in mid-1981 at a new facility that will increase iodine production by 500 metric tons per year. Exports of iodine in 1980 were valued at $30.4 million, a 43% increase over the 1979 value of $17.4 million. Iodine exports in 1980 went mainly to Europe (65%), the United States (19%), and Latin America (16%).

Lithium.—Chile has an estimated 4.0 million metric tons of metallic lithium, 40% of the world's identified reserves, contained in brines located in the Salar de Atacama and Salar de Pedernales areas of the Atacama Desert. CORFO (the State-owned Chilean development corporation) and the Foote Mineral Co., a subsidiary of Newmont Mining Corp. of the United States, signed a 30-year contract forming a joint venture, Sociedad Chilena de Litio Ltda., to exploit the lithium content of the brine deposit located beneath the 16,700 hectares of the Salar de Atacama, near Antofagasta (Region II). CORFO owns 45% and Foote Mineral, 55%. The extraction plant is expected to produce up to 1,000 metric tons of metallic lithium per year. The investment necessary to develop this operation is estimated to be about

$30 million. Yearly revenues from this operation are expected to reach $14 million at present lithium prices. SCL estimated that the plant will start production in 1984, at the rate of 5,500 metric tons of lithium carbonate per year. Any additional minerals recovered in the processing (magnesium oxide, potassium chloride, etc.) will belong to the Government, which is also considering a possible joint venture with Union Oil Co. for recovery of 400,000 metric tons per year of potassium oxide from the Salar de Pedernales.

Nitrates.—The production of nitrates held fairly steady in 1980, while output of nitrate byproduct rose slightly. Mining of sodium and potassium nitrates, the major product in this sector, decreased 0.2% to 620,400 metric tons.

Sodium sulfate production increased 2.0% to 70,100 metric tons. The value of nitrate exports was up 21% to $55.8 million in 1980 over $44.4 million in 1979. Nitrate exports in 1980 went to Europe (31%), the United States and Canada (35%), Latin America (25%), and Asia (9%).

Other Nonmetals.—One of the highest mines in the world is producing sulfur at the 6,000-meter (19,700 feet) altitude in Chile, on the upper slopes of the dormant volcano of Aucanquilcha, locally known as The Devil's Hill (near the Town of Amincha close to the Bolivian border). The ore is reported to contain 50% to 60% sulfur. After refining, the sulfur is used to manufacture sulfuric acid for the vast copper mine at Chuquicamata. Front-end loaders load the ore into trucks; the ore is then transported down to the Angulo railroad station at 5,200 meters (17,000 feet) by an aerial tramway. The mine was originally developed in 1913 for the extraction of sodium nitrate for saltpetre manufacture.

CORFO, through the Committee for Mixed Salts, has a second project for recovery of boron from the salts of the Salar de Atacama. International tenders will be sought in 1981. Reserves in an area known as the nucleus of the Salar de Atacama amount to 4 million metric tons of lithium and 11 million metric tons of boric acid together with 57 million metric tons of potassium and 26 million metric tons of magnesium.

MINERAL FUELS

Coal.—Coal production declined 18.7% in 1980 to 778,000 metric tons following the trend begun in 1974. The principal cause was over exploitation of the old mines worked by ENACAR, which has been closing its less efficient operations. Production began to rise to previous levels at the end of 1980. In 1981, the total coal mined is expected to duplicate the amount registered in 1979. Preliminary studies placed resources of subbituminous coal in the Magallanes Region XII at over 4 billion metric tons.

This broad assessment encouraged CORFO to form the Subbituminous Coal Committee to carry out closer prospecting and feasibility studies to pinpoint those parts of the prospect for possible exploitation. It was concluded that the Pecket deposit, the Riesco, and the Dorotea-Natales sectors were the most promising areas. At the beginning of 1980, the prospecting functions of ENACAR were transferred to the Subbituminous Coal Committee. Reportedly, the Comisión Nacional de Energía has engaged the services of Société Francaise d'Etudes Minières of France to carry out further technical and economic feasibility studies on the most favorable locations. The Pecket coal occurrences, not far from Punta Arenas in Chile's far south near the Straits of Magellan, are the most promising. A preliminary study indicates that for an initial investment estimated at some $100 million, the two seams can yield about 2 million metric tons per year of coal over 25 years (or more). Compañía de Petróleos de Chile S.A. (COPEC) presented a $3.5 million offer for CORFO's Pecket coal deposit in Magallanes. The $3.5 million offer, according to COPEC officials, will compensate the Government for costs incurred by CORFO and the National Energy Commission.

Pecket will be exploited by Compañía de Carbón de Chile, a newly created consortium consisting of COPEC, Northern Strip Mining Ltd., Davy McKee Corp., and K. Wardell and Partners. Before mining can begin, support infrastructure will have to be built, including roads, buildings, electric energy generating plants, and a port capable of handling 40,000-metric-ton vessels. An initial investment of $50 to $60 million over the first 4 to 5 years is expected. Exploitation of the deposit will provide employment for 200 to 350 workers. Coal obtained from the Pecket deposit (4,500 calories), with an extraction cost of $30 per ton, compares favorably with the cost of importing coal, $75 per metric ton with a 6,000-calorie content. The Pecket deposit will be Chile's first open pit coal mine,

although it will also be exploited by underground methods. Chilean current coal production is 1 million metric tons per year. ENACAR has announced that there were no takers when the Schwager Coalfield was put up for auction to local and foreign bidders. ENACAR now has to decide what to do with the coalfields, which are excessively costly to operate. The work force had fallen from 15,000 in 1973 to 1,600 at the beginning of 1980.

Petroleum and Natural Gas.—In 1980, production of crude oil increased to 1.9 million cubic meters (12 million 42-gallon barrels), a 58% increase over 1979's output and equivalent to 34% of total domestic consumption. New production was obtained from offshore wells that came onstream during 1979 and 1980. ENAP has been building offshore facilities to handle the larger output of crude oil and petroleum products, thus making further production increases possible. Consumption of fuel oil decreased 0.06% in 1980 owing to the greater efficiency of consumer installations and the substitution of coal for fuel oil.

Chile is expected to produce 41% of its national petroleum consumption requirements in 1981 and 45% in 1982. Domestic production had not been slated to reach this level until 1983. Exploratory drilling programs by ENAP and foreign companies began in 1980 at additional locations. A $50 million offshore oil exploration program will be carried out by ENAP, starting in December 1980 in an area that extends seaward between the mouths of the Maule and Bio-Bio Rivers. The exploration zone is about 12,000 square kilometers. ENAP expressed optimism on finding oil in this region based on the thickness of the sedimentary basin in the Pacific offshore. Oil and natural gas is expected to be found not very deep and will be explored by the General, a semisubmergible platform under contract from the Diamond M Corp. of the United States. Atlantic Richfield Co.-ARCO Petróleos Chile and Amerada Hess Petróleo Chile will renew offshore exploration after breaking off the program in March 1980 for the winter season. A renewal program of exploration will begin in November 1980 with the arrival of a dynamically positioned drill ship leased from IDELCO. ARCO intends to drill exploratory wells off Chiloé Island and further south. The first of these exploratory wells, Chepu No. 1, will be drilled in 148 meters (390 feet) of water to an expected depth of 1.707 meters (5,630 feet) by the Ben Ocean Lancer. Other offshore developments included the addition of a fixed platform at Spiteful Field, which will add nine new wells for petroleum production. The offshore program of oil production in Magallanes presently includes Ostión with one fixed platform and Spiteful with two fixed platforms and comprises 57% of total production in Magallanes or about 18,000 barrels daily.

Production of natural gas totaled 240,000 million cubic feet in 1980, decreasing slightly from that of 1979. The volume of gas reinjected amounted to 97,716 million cubic feet, up 4% from 94,043 million cubic feet per year earlier. A $400 million liquid natural gas project at Cabo Negro in the Magallanes area (Region XII) is in the final planning stage. The projected production is exclusively for export and the project is expected to come onstream during the 1980's. Current estimates are for a plant capacity to liquefy 7 million cubic meters (250 million cubic feet) of gas daily. Once the design is completed, the plant will take at least 3 years to be installed. Two Japanese companies, Mitsubishi Corp. and Nichimen Corp., are in negotiation with Gas de Chile, Ltda., for the purchase of the entire output planned for the Magallanes' Cabo Negro project.

Natural gas is also the subject of exploration that has yielded positive results. ENAP has undertaken a program that will eventually permit the export of surplus natural gas in significant quantities after domestic market requirements have been satisfied.

Other.— CORFO continues developing El Tatío geothermal field. A 30-megawatt geothermal powerplant is being planned at El Tatío, located in Loa Province (Region II) at 4,300 meters (14,000 feet) elevation. The $42 million plant, which will operate on natural energy produced by geysers, will supply power to the Chuquicamata copper mine located 120 kilometers (74.6 miles) away. A United Nations financed feasibility study was completed by Electro Consult, an Italian firm.

During 1980, CORFO updated its studies on the capacity of El Tatío geothermal field and the installations necessary to produce a minimum potential of 15,000 kilowatts. Definite plans for working this geothermal field will be available in 1982 and work can begin 30 days after a public concession document is accepted. It will take 4 years to complete the project, which will generate energy for use in Chile's large-scale mining sector.[6]

In the energy sector, a series of plans and programs have been laid out to minimize domestic dependence on foreign supplies. Petroleum products, the largest import item, which had reached as much as one-third of total imports, fell to less than 19% in 1980 and can be expected to continue to decline as offshore drilling yields greater production and as other types of energy, such as coal or hydroelectric power, are used as replacements. Demand for energy has increased by an annual average of 4.6% over the last 4 years, creating the need to develop greater productive capacity.

The National Energy Commission is coordinating the planning effort to meet projected demand. Increased emphasis has been placed on the production of hydroelectric power since only 7.9% of the country's capacity for this type of energy has been tapped to date. Consumption of electric power has increased by an annual average of 7% during the last 6 years. Several projects have been announced by ENDESA and a consortium of private companies to meet demand, which is expected to grow by more than 6% per year over the next decade. The most important projects are the completion of the 300-megawatt Antuco plant, which is expected to become operational in 1981, and Colbún-Machicura, which will have a first-stage generating capacity of 490 megawatts and is scheduled to come on line in 1985. Studies are underway for two major plants, Neltume and Pehuenche, which will have a combined capacity almost equal to that of the Antuco and Colbún-Machicura facilities.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Chilean pesos (CH$) to U.S. dollars at the rate of CH$39.00=US$1.00 exchange rate as of Dec. 31, 1980.

[3]U.S. Embassy, Santiago, Chile. GAO Review—An Assessment of Federal Efforts to Assure Mineral Supplies By Encouraging Overseas Exploration and Development Investment. Department of State Airgram 011629Z, Apr. 30, 1981.

[4]Corporación de Fomento de la Producción. Chile 1980 Economic Profile. P. 10.

[5]Corporación de Fomento de la Producción. Chile Economic Report. March 1981, p. 7.

[6]Corporación de Fomento de la Producción. Chile Economic Report. April 1981, p. 6.

The Mineral Industry of China

By Edmond Chin[1]

In the early seventies, the principles of China's economic development were readjustment, restructuring, consolidation, and improvement. The modernization program—encompassing agriculture, industry, science and technology, and defense—was to bring the country into the ranks of the advanced and industrialized nations of the world by the year 2000. This ambitious program, composed of 120 major projects, was embodied in China's 10-year plan for 1976-85. After introspection and examination, the primary concern of the Chinese was readjustment; a readjustment in policy by Government planners in 1978 to a more realistic, albeit a slower, development program and one structured on market socialism. A new program, the sixth 5-year plan, replaced the existing 10-year plan, which was to become actually a part of a new 10-year economic plan for 1981-90 and was to emphasize investment priorities in light industry and agriculture.[2]

The main tasks for 1980-81 were to accelerate growth of agriculture and light industry to supply consumer goods commensurate to a rise in purchasing power; increase energy supplies; improve communications service and the construction industry; and readjust production in the metallurgical, chemical, and other heavy industries to support the output in agriculture and light industry and to serve the economy as a whole. The State expounded six guidelines to ensure the success of the 1980-81 objectives. First, in agriculture, the autonomy in decisionmaking by the production unit was to be respected, each unit was to proceed from existing conditions, and responsibility was to be assigned to smaller groups. Second, nationwide attention would be given to light industry to broaden sources of raw materials so as to increase production. Third, equal stress was to be placed on exploiting energy sources and energy conservation. Fourth, further readjustments in heavy industry would be made, as needed, especially in the machine-building industry. Fifth, although higher education will continue to develop, a number of middle schools would be converted into professional and technical training schools. Sixth, experiments in restructuring economic management were to be expedited, and the autonomy of State-owned industries was to be expanded. The main economic targets for 1981 in million tons were steel, 35; cement, 78; coal, 620; and crude oil, 106. Electric power generation was to increase 4% to 312 billion kilowatt-hours. Total industry output value was to increase 6% over 1980, and the total agricultural output value was to increase 4%. Domestic retail trade was to reach 220 billion yuan compared with 55.9 billion yuan for foreign trade.[3]

According to preliminary data released by the State Statistical Bureau, China's total industrial output value in 1980 was 497 billion yuan, 8.4% more than in 1979. The national electric power output was 297 billion kilowatt-hours, an increase of 5.4% over that of 1979. The planned 1980 targets for 83 major industrial products were fulfilled or overfulfilled. Quotas for steel, pig iron, rolled steel, and nonferrous metals were surpassed. All targets for 18 major chemical products, including fertilizers, sulphuric acid, soda ash, and caustic soda, were fulfilled; fertilizer output, for instance, was 17.5% more in 1980 than in 1979. However, China's outputs of crude oil and raw coal were 0.2% and 4.7% less, respectively, than

in the previous year.

During 1979-80, China's industries underwent restructuring and amalgamation to attain full potential and move faster toward production specialization, regardless of locality and ownership. By the end of 1980, 19,300 enterprises were amalgamated into 1,900 specialized companies or plants. Some enterprises also had begun to set up, on a trial basis, national specialized companies. In Liaoning Province, for example, 2,098 enterprises were reorganized under the management of 122 specialized companies and 65 general plants. The combined output values of the new management system accounted for about one-fifth of the Province's total industrial and transportation enterprises. In addition, 953 small units were merged into various joint ventures, thereby increasing their combined output value and profits. After 30 years, China had reportedly built 400,000 industrial and transport enterprises, with a total asset of 800 billion yuan.

Annual per capita gross national product increased from $155 in 1975, to $162 in 1976, $171 in 1977, $208 in 1979, and to around $240 in 1979.[4] [5] No estimate was reported for 1980. The average annual per capita income in State-run enterprises was 781 yuan in 1980, and per capita income of each working family was 395 yuan. Between 1977 and 1980, 26.6 million young people and other jobless persons found employment. The average per capita peasant income in 1980 was around 170 yuan. China's population growth rate was 1.17% in 1979 and was expected to drop to 1% in 1980. Total population was estimated at 970 million in 1980.[6]

Government revenue in 1979 was 110 billion yuan, and expenditure was 127 billion yuan. The deficit of 17 billion yuan was a result of higher State purchase prices for major farm products and the reduction or remittance of the agricultural tax in poor areas; increase in wages and in the number of new jobs; retention of a percentage of profits by localities and enterprises; increase in investments in agriculture and light industry; increase in national defense expenditure; and payment of back salaries and financial aid to people injured as a result of the Cultural Revolution. Surplus accumulation from previous years (8.0 billion yuan) and an overdraft (9.0 billion yuan from the People's Bank of China) covered the deficit in 1979. The budget deficit in 1980 was 12 billion yuan for which the bank issued 7.6 billion yuan in banknotes.

China's total trade in 1980 was 56 billion yuan[7] and was expected to be around 60 billion yuan in 1981. Japan, the United States, and the Federal Republic of Germany, in that order, were China's largest trade partners. To promote international financial transactions, the State Council established the State Administrative Commission on Import and Export Affairs and the Foreign Investment Commission. The former organization was to supervise overall foreign trade, and the latter was created to oversee foreign investments in China. In addition, the State General Administration of Exchange Control was established to exercise control over foreign exchange, and the China International Trust and Investment Corp. was created to handle joint ventures with foreign investors. The Bank of China was restructured and placed directly under the leadership of the State Council. Domestic branch offices were increased to 114 by yearend 1980, and overseas offices were increased to 207, with 196 in Xianggang (Ying Shan) and Aomen, 6 in Singapore, 3 in the United Kingdom, and 1 in Luxembourg. A representative office was established in Tokyo, and preparations were made to set up a branch in New York City and a representative office in Paris.

The Bank of China has also established correspondent relations with 2,735 branches of 1,033 banks in 144 countries. China's representation in the International Monetary Fund and the World Bank was restored in 1980.

During 1980, the Government promulgated a law on individual income tax and a law on joint-venture income tax. The latter law covers income derived from production, business, and other sources by any joint venture with Chinese and foreign investment in China. The income tax rate on joint ventures was to be 30%, with an additional local surtax of 10% of the assessed income tax to be levied. The income tax rates on joint ventures for petroleum, natural gas, and other resources were to be stipulated separately. Upon appropriate approval, a newly established joint venture, scheduled to operate for a period of 10 years or more, may be exempt from income tax in the first profitmaking year and allowed a 50% reduction in the second and third years. Joint ventures in low-profit operations and in remote, economically undeveloped outlying areas may be allowed a 15% to 30% reduction in income tax for a period of 10 years, following the expiration of the term for ex-

emptions and reduction mentioned earlier.

According to the Foreign Investments Commission of the Foreign Investment Council, 20 joint venture contracts for projects within China were approved in 1980, the country's first year with joint ventures, amounting to $177 million, of which the Chinese invested $35 million. In addition, 33 joint-venture projects were formed by Chinese ($38.4 million) and foreign parties ($44.4 million) to operate in other countries. Between $600 and $700 million was invested by foreigners in cooperative production ventures; the foreign party provides all the necessary capital, and the Chinese provide land and labor. Cooperative production ventures are turned over to the Chinese after 10 or 20 years. Agreements were signed with French and Japanese oil companies in 1980 to develop China's offshore oil. Foreign parties were to contribute $500 million (Chinese were to contribute $300 million) and were to be repaid in oil. In 1980, 5,400 compensation trade contracts were signed, under which foreign participants were to provide equipment valued at $112 million and were to be repaid with finished products. In 1979, the China International Trust and Investment Corp. was established to attract foreign investments for various Chinese projects. To date, $14 million has been invested in mining projects, including molybdenum and phosphorus, in four Provinces.

The Capital Construction Commission reported that 60 integrated projects and 183 disparate projects were completed and began operations in 1980. These included new coal operations, with a combined annual capacity of 7 million tons; new oil well development; new annual cement capacity of 1.5 million tons; and the installation of a generating capacity of 2.5 million kilowatts of electricity. Annual freight-handling capacity of ports increased by 7 million tons, and 900 kilometers of new railway were opened to traffic.

Because of growing financial commitments in the national budget, a wider trade deficit because of imports of whole plant purchases and technology-intensive equipment, and domestic inflation, the Government planned cuts in expenditures, and delays, or even curtailment, of some major projects. There was talk of delays or suspension of large industrial projects, which if true would be costly and problematic to foreign investors mostly from Japan, the United States, and the Federal Republic of Germany. The project most criticized for poor planning by the Chinese was the new integrated steelworks at Baoshan. Chinese officials were also to decide the fate of several proposed petrochemical plants,[8] as well as several mining ventures. However, it was expected that work on coal and oil exploration and development would continue. The Government announced also that China would not be able to honor oil export commitments through 1985 and that the country's oil potential had been exaggerated. Moreover, the Government announced that it expected rational domestic use of energy by its industry, and exhorted energy-conservation measures.

The Ministry of Geology continued to announce significant finds of minerals throughout the year.[9] [10] [11] Significant reserves of 132 minerals have been found. Wolfram deposits are three times those in the rest of the world. Rare-earths minerals make up 70%, and antimony makes up 44% of the world's total. Deposits of iron, copper, bauxite, lead, zinc, tin, coal, phosphorus, gypsum, and salt rank among the largest in the world. Some minerals are not being fully extracted, resulting in serious waste. The quantities of chromite, platinum, potassium, and diamonds now mined cannot meet economic needs. Although a considerable number of reserves of important minerals are known, there are not many large reserves. There are quite a lot of mixed-mineral deposits with small reserves.[12] A map delineating the country's mineral deposits, reproduced from an article by Hsu Chieh, in the April 1981 edition of China Reconstructs (V. 30, No. 4) is shown in figure 1.

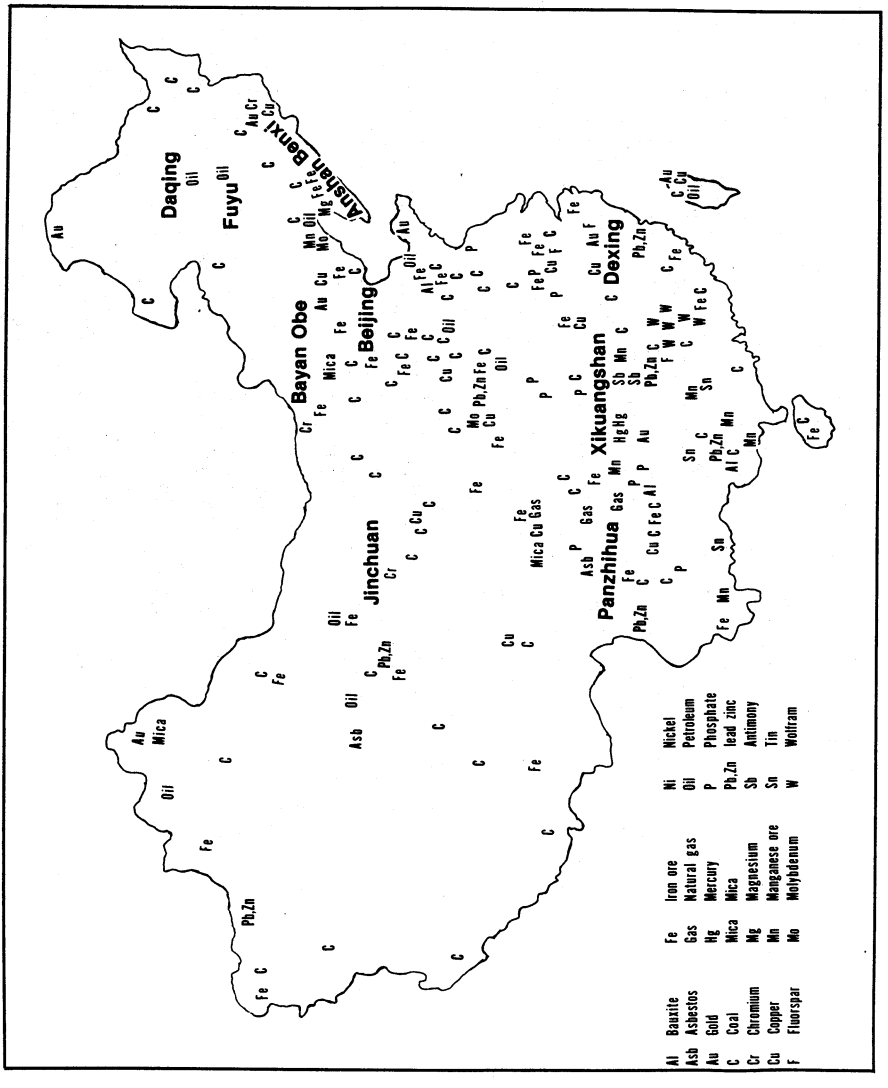

Figure 1.—Geographical distribution of China's mineral deposits.

The Ministry of Geology was devoting more attention to research on basic geologic theory and to the development of expertise in prospecting engineering (remote sensing, physical and chemical prospecting). Greater use of electronic computers was to be encouraged, and technical exchanges and cooperation with foreign countries were to increase. For example, China and France began research on the geological structure of the Himalayas. China and the Federal Republic of Germany were conducting a joint survey and prospecting for molybdenum, columbite, and tin in Hunan Province. A number of countries were cooperating in oil exploration.

PRODUCTION

Since June of 1979, China's State Statistical Bureau (SSB) has been publishing numeric data on select national aggregates. According to SSB, the country's value of gross industrial output (GIO) grew from 373 billion yuan in 1977 to 423 billion yuan in 1978, 459 billion yuan in 1979, and 498 billion yuan in 1980. The average annual growth in GIO during the period was 10.1% compared with 8.4% for the 1980 output. In 1979, the Government announced its decision to emphasize the development of light industries. Reflecting this change in policy, the value of GIO by the light industry sector rose from 198 billion yuan in 1979 to 232 billion yuan in 1980, but the output by the heavy industry sector increased only from 261 billion yuan to 265 billion yuan.

SSB thus far has only reported annual production of the following mineral-related commodities: Fuels—coal, coke, crude oil, and natural gas; metals—pig iron, crude steel, and rolled steel; nonmetallics—caustic soda, cement, salt (for human consumption), soda ash, and sulfuric acid.[13] In addition, output of fertilizers was given for 1977-79. SSB also reported that the output of copper ore, zinc ore, and pyrite, as well as eight other products were not fulfilled under the 1979 economic plan. Output of 10 nonferrous metals, however, was said to have surpassed 1 million tons in 1979, a 12.8% increase over that of 1978. Although only aluminum, copper, tin, and tungsten were specifically noted in the communique as among the 10 metals, lead and zinc presumably must be included.

Although official data are lacking, China is a significant world producer of antimony, barite, fluorspar, graphite, magnesite, tin, and tungsten. In addition to the aforementioned, China is believed to be an important producer, also by world standards, of rare-earth elements, tantalum, and vanadium, as well as a potential significant producer of cobalt, chromium, gold, molybdenum, nickel, platinum-group metals, titanium, and uranium.

The Ministry of Geology, in a concerted effort with its provincial and local counterparts, encouraged surveying of existing mining areas and prospecting for undiscovered mineral deposits. The Government also was to award bonuses for new finds that could be developed. In 1980, various geological departments completed 29 reports on the prospecting of a number of areas. Included in these reports were surveys on diamond, graphite, gypsum, lead-zinc, mercury, and tin. One of the most active minerals reconnaissance programs encouraged by the State was for precious metals.

Table 1.—China: Estimated[1] production of mineral commodities[2]

(Metric tons unless otherwise specified)

Commodity[3]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite, gross weight[4]	r1,300,000	r1,500,000	r1,500,000	1,500,000	1,500,000
Alumina, gross weight	r750,000	r750,000	r750,000	r750,000	750,000
Metal, refined, primary	r320,000	r350,000	r360,000	r360,000	360,000
Antimony, mine output, metal content	r8,400	r10,000	r10,000	r10,000	10,000
Bismuth, mine output, metal content	r220	r225	r240	r260	260
Cadmium metal, smelter	r200	r200	r220	r225	225

See footnotes at end of table.

Table 1.—China: Estimated[1] production of mineral commodities[2] —Continued

(Metric tons unless otherwise specified)

Commodity[3]	1976	1977	1978	1979	1980[p]
METALS —Continued					
Copper:					
Mine output, metal content	[r]180,000	[r]195,000	[r]200,000	[r]200,000	200,000
Metal:					
Smelter, primary and secondary	[r]180,000	[r]195,000	[r]200,000	[r]200,000	200,000
Refined, primary and secondary	[r]240,000	[r]260,000	[r]270,000	[r]280,000	280,000
Gold, mine output, metal content—troy ounces	80,000	100,000	150,000	200,000	225,000
Iron and steel:					
Iron ore, gross weight[5] —thousand tons	[r]60,000	50,000	70,000	75,000	75,000
Pig iron —do	[r]28,800	[6]25,050	[6]34,790	[r 6]36,730	[6]38,020
Ferroalloys, blast furnace and electric furnace:					
Ferromanganese —do	190	230	310	340	340
Ferrosilicon —do	100	110	150	160	165
Silicon metal —do	5	5	8	10	15
Ferrochromium—do	60	70	90	90	90
Other —do	25	35	42	50	50
Total —do	380	450	600	650	660
Crude steel —do	[r]20,500	[6]23,740	[6]31,780	[6]34,430	[6]37,120
Rolled steel —do	[r]14,700	16,330	[6]22,080	[6]24,970	[6]27,160
Lead:					
Mine output, metal content	[r]130,000	[r]135,000	[r]145,000	[r]155,000	155,000
Metal, refined, primary and secondary	[r]140,000	[r]150,000	[r]160,000	[r]170,000	170,000
Magnesium metal, primary	[r]5,000	5,000	6,000	6,000	7,000
Manganese ore, gross weight —thousand tons	1,000	[r]1,150	1,300	1,500	1,600
Mercury, mine output, metal content 76-pound flasks	[r]18,000	20,000	20,000	20,000	20,000
Molybdenum, mine output, metal content	1,500	1,500	2,000	2,000	2,000
Nickel:					
Mine	10,000	11,000	11,000	11,000	11,000
Smelter	9,000	10,000	10,000	10,000	10,000
Silver, mine output, metal content thousand troy ounces	1,000	1,000	1,500	2,000	2,500
Tin:					
Mine output, metal content	[r]11,000	[r]13,000	[r]14,000	[r]14,000	14,600
Metal, smelter	[r]11,000	[r]13,000	[r]14,000	[r]14,000	14,600
Tungsten, mine output, metal content	[r]5,700	[r]6,600	[r]7,100	10,000	15,000
Zinc:					
Mine output, metal content	[r]150,000	[r]155,000	[r]160,000	[r]160,000	160,000
Refined, primary and secondary	[r]150,000	[r]155,000	[r]160,000	[r]160,000	160,000
NONMETALS					
Asbestos	150,000	200,000	250,000	250,000	250,000
Barite	300,000	350,000	400,000	500,000	680,000
Cement, hydraulic —thousand tons	[r]49,300	[r 6]55,650	65,240	[6]73,900	[6]79,860
Fluorspar	350,000	400,000	400,000	400,000	400,000
Graphite	50,000	60,000	80,000	100,000	100,000
Gypsum —thousand tons	1,000	1,000	1,500	2,000	2,000
Kyanite	1,500	1,500	2,000	2,500	2,500
Lithium minerals, all types	9,000	10,000	10,000	10,000	10,000
Magnesite—thousand tons	1,000	1,500	1,800	2,000	2,000
Nitrogen: N content of ammonia —do	4,070	5,620	6,750	7,170	7,500
Phosphate rock and apatite —do	4,000	4,000	4,500	[r]5,500	5,500
Potash, marketable, K_2O equivalent —do	[r]12	[r]18	[r]21	[r]16	12
Pyrite, gross weight —do	2,000	[r]2,800	[r]3,600	[r]3,700	3,800
Salt —do	20,000	[r]17,100	[r 6]19,530	[r 6]14,770	[6]17,280
Sodium compounds: Sodium carbonate, natural and synthetic —do	1,000	[r 6]1,077	[6]1,329	[r 6]1,486	[6]1,613
Sulfur:					
Native	150,000	200,000	200,000	200,000	200,000
Content of pyrite	900,000	[r]1,252,000	[r]1,605,000	[r]1,682,000	1,700,000
Byproduct, all sources	300,000	300,000	350,000	400,000	400,000
Total	1,350,000	[r]1,752,000	[r]2,155,000	[r]2,282,000	2,300,000
Talc and related materials	150,000	150,000	150,000	150,000	150,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite —thousand tons	20,000	25,000	30,000	35,000	35,000
Bituminous and lignite —do	460,000	525,000	588,000	[r]600,000	585,000
Total —do	480,000	550,000	618,000	[r 6]635,000	[6]620,000
Coke, all types —do	[r]20,500	[r]23,100	[r 6]32,375	[6]33,540	34,050

See footnotes at end of table.

Table 1.—China: Estimated[1] production of mineral commodities[2] —Continued

(Metric tons unless otherwise specified)

Commodity[3]	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Gas, natural:					
Gross billion cubic feet	385	465	535	565	555
Marketed do	350	425	[e]485	[e]512	[e]504
Petroleum:					
Crude (including crude from oil shale) thousand 42-gallon barrels	[r]633,000	684,000	[e]760,000	[e]775,000	[e]773,435
Refinery products do	548,000	650,000	600,000	620,000	620,000

[p]Preliminary. [r]Revised.

[1]Except those figures specifically footnoted as reported.

[2]Table includes data available through July 1, 1981.

[3]In addition to the commodities listed for which quantitative estimates of output have been made, China is known or believed to have produced the following commodities for which no estimates, even of order of magnitude, have been prepared, owing to a paucity of general information upon which to base an estimate: Arsenic, chromite, titanium minerals, uranium, boron minerals, various clays (including kaolin), feldspar, lime, mica, sand, various industrial and dimension stones, and carbon black. Other unlisted commodities also may be produced.

[4]Diasporic bauxite; includes an estimated 165,000 metric tons per year of production for refractory applications.

[5]In terms of 50% Fe ore.

[6]Reported figure.

TRADE

China's total two-way trade was estimated at $34 billion in 1980 compared with $30 billion in 1979.[14] [15] Exports in 1980 were $15 billion; about two-thirds of the country's exports are composed of light industrial and textile products, and agricultural and sideline products. Imports in 1980 were valued at $19 billion. Principal imports were heavy machinery and equipment to support the country's modernizations program. China's major trading partners were the United States, Japan, and member countries of the European Communities.[16]

By March 1980, China displaced the U.S.S.R. as the leading United States trade partner among the centrally-planned economies. To promote further trade, a Chinese trade exhibit toured the United States in 1980, and a U.S. trade exhibition was held in Beijing on November 17-28. The five main themes of the United States show in China were petroleum exploration and extraction equipment, power generation and distribution, agricultural machinery, transportation, and light industrial machinery.

Since the latter half of 1979, the foreign trade structure of China has been undergoing reform. First, the structure and scope of national trade corporations under the Ministry of Foreign Trade were readjusted. Some headquarter offices no longer were engaged in direct export, while others handled only a few important commodities. For instance, trade of antimony, tin, and tungsten was controlled by the head office of the China National Metals & Mineral Import & Export Corp. (Minmetals). Items such as aluminum, lead, and zinc ingot, and ferrotungsten could be handled by the head office of Minmetals or by the Ministry of Metallurgical Industry. Items such as bismuth; cadmium; chromium; ferrochrome, -manganese, -molybdenum, -silicon, -titanium, and -vanadium; manganese; molybdenum; rare earths; and titanium could be handled locally or centrally. Second, foreign trade corporations were established in three municipalities (Beijing, Shanghai, and Tianjin); in four Provinces (Guangdong, Fujian, Hebei, and Liaoning); and in one autonomous region (Guangxi). Third, trade corporations were established under the relevant ministry as well as the Chinese Academy of Science to engage in joint ventures, coproduction, compensatory trade, material processing, and assembly. Fourth, transregional joint enterprises were to be set up among production departments. And lastly, some industrial plants, mines, farms, and grassroot enterprises, with approval by the appropriate authority, were to control exports directly.

China has trade relations with about 170 countries, and the variety of export commodities number about 50,000 items.

Table 2.—China: Apparent exports of selected mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Bauxite	86,522	209,181	Italy 74,971; Japan 36,659; West Germany 24,444; United States 23,839.
Oxide and hydroxide	10,398	13,642	Thailand 6,850; Singapore 1,838; Hong Kong 1,382.
Metal including alloys:			
Unwrought	--	2,721	France 2,074; Thailand 647.
Semimanufactures	r1,334	2,019	Hong Kong 1,748; Sri Lanka 48; Indonesia 45.
Antimony:			
Ore and concentrate	249	3,395	Yugoslavia 2,015; France 856; West Germany 307.
Metal including alloys, all forms	4,980	5,412	Japan 2,895; United States 1,234; France 665.
Arsenic:			
Natural sulfides	10	13	Thailand 8; Macau 5.
Trioxide, pentoxide, acids	253	214	Thailand 78; Greece 50; Japan 50.
Chromium:			
Chromite	80	--	
Oxide and hydroxide	40	76	Indonesia 50; Hong Kong 26.
Cobalt:			
Oxide and hydroxide	--	4	All to Japan.
Metal including alloys, all forms	--	3	All to West Germany.
Copper:			
Ore and concentrate	--	1	All to United Kingdom.
Sulfate	105	231	Japan 215.
Metal including alloys:			
Scrap	--	820	All to Hong Kong.
Unwrought	455	35	Italy 30.
Semimanufactures	1,495	2,761	Hong Kong 2,368; Pakistan 159; Singapore 113.
Iron and steel:			
Ore and concentrate	38	196	Pakistan 97; United States 57.
Metal including alloys:			
Scrap	177	440	Japan 263; Saudi Arabia 172.
Pig iron	6,475	28,079	Pakistan 14,278; Hong Kong 8,742; Singapore 4,100.
Ferroalloys	277	766	Sweden 411; Venezuela 154; Yugoslavia 115.
Steel, primary forms	NA	46,347	Pakistan 31,602; Hong Kong 11,409.
Semimanufactures:			
Bars, rods, angles, shapes, sections	143,000	170,961	Hong Kong 132,226; Saudi Arabia 16,594.
Plates and sheets	6,529	10,744	Hong Kong 5,303; Nigeria 2,857.
Hoop and strip	431	715	Pakistan 178; Indonesia 177; Hong Kong 161; Thailand 155.
Rails and accessories	--	4	All to Cameroon.
Wire	25,369	33,570	Hong Kong 13,879; Singapore 6,332; Thailand 4,840.
Tubes, pipes, fittings	10,125	22,756	Hong Kong 13,711; Saudi Arabia 5,164; Pakistan 1,038.
Castings and forgings, rough	1,219	2,294	Saudi Arabia 987; Japan 646; West Germany 271.
Lead:			
Ore and concentrate	1,500	1,100	All to Thailand.
Oxide	403	751	Japan 424; Hong Kong 105; Thailand 101.
Metal including alloys:			
Unwrought	r128	20	All to Indonesia.
Semimanufactures	r10	7	Saudi Arabia 6.
Magnesium metal including alloys, all forms	1	--	
Manganese:			
Ore and concentrate	46,346	45,961	Japan 43,419; Italy 1,060.
Oxide	1,609	1,516	Hong Kong 903; Singapore 312; Italy 200.
Metal including alloys, all forms	25	39	All to West Germany.
Mercury 76-pound flasks	r6,632	8,584	Hong Kong 1,943; United States 1,392; Italy 986; West Germany 957.
Molybdenum ore and concentrate	60	494	Japan 412; West Germany 67.
Nickel metal including alloys:			
Unwrought	--	19	All to United Kingdom.
Semimanufactures	4	4	All to Trinidad and Tobago.
Niobium ore and concentrate	--	29	All to Japan.
Silver:[3]			
Ore and concentrate, value, thousands	--	$3	All to Pakistan.
Waste and sweepings, do.	--	$62	All to West Germany.
Metal including alloys, unworked or partly worked, do.	$4	--	
Tin metal including alloys:			
Unwrought	5,060	3,170	Yugoslavia 1,156; Netherlands 805; Japan 270; France 255.
Semimanufactures	108	124	Hong Kong 78; Singapore 42.

See footnotes at end of table.

Table 2.—China: Apparent exports of selected mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Titanium:			
Ore and concentrate	569	--	
Oxide	1,225	1,588	Japan 559; Hong Kong 423; United Kingdom 301.
Metal including alloys, all forms	NA	222	West Germany 127; France 50; United States 45.
Tungsten:			
Ore and concentrate	3,227	6,674	West Germany 1,726; Austria 1,423; Poland 859; United States 849.
Metal including alloys, all forms	7	9	Mainly to Yugoslavia.
Zinc:			
Oxide	914	935	Japan 562; United Kingdom 140.
Metal including alloys:			
Blue powder	--	12	Japan 5; Hong Kong 5.
Unwrought	r10,569	6,802	Hong Kong 2,994; Japan 1,838; Thailand 958.
Semimanufactures	28	123	Saudi Arabia 64; Pakistan 50.
Zirconium metal including alloys, all forms kilograms	--	50	All to Japan.
Other:			
Ores and concentrates	2,455	1,675	Italy 540; United States 369; Belgium-Luxembourg 368.
Ash and residue containing nonferrous metals	427	447	Hong Kong 440.
Oxides, hydroxides, peroxides, n.e.s	295	6,536	Pakistan 3,472; United States 1,675; Netherlands 265.
Metalloids	16	84	Hong Kong 67.
Alkali and rare-earth metals	NA	10	All to Sweden.
Base metals including alloys, all forms, n.e.s	1,724	1,368	Hong Kong 543; Japan 361; United Kingdom 71.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	325	274	All to Japan.
Dust and powder of natural or synthetic precious and semiprecious stones value, thousands	--	$4	Hong Kong $3.
Grinding and polishing wheels and stones	r730	1,289	Hong Kong 561; Indonesia 380; Thailand 175.
Asbestos	6,026	9,556	Thailand 5,308; Hong Kong 1,734; Indonesia 1,620.
Barite and witherite	r151,550	360,990	United States 211,910; Netherlands 76,351; West Germany 43,217.
Boron oxide and acid	141	212	Egypt 150; Thailand 25; Hong Kong 20.
Cement thousand tons	718	808	Hong Kong 725; Macau 77.
Chalk	30	23	Venezuela 20.
Clays and clay products:			
Crude clay	84,484	145,437	Japan 102,912; Hong Kong 28,543.
Products:			
Refractory	6,210	5,638	Indonesia 3,539; Pakistan 741.
Nonrefractory	23,544	29,940	Hong Kong 27,504; Singapore 1,405.
Cryolite and chiolite, natural	433	540	United States 535.
Diamond:			
Gem, not set or strung value, thousands	$2,002	$2,873	Hong Kong $1,242; Japan $1,162.
Industrial do	$1,035	$2,022	All to Belgium-Luxembourg.
Diatomite and other infusorial earth	11	21	Japan 20.
Feldspar and fluorspar	170,383	250,773	Japan 208,548; Australia 13,781; Hong Kong 12,878.
Fertilizer materials:			
Crude:			
Nitrogenous	480	60	All to Indonesia.
Phosphatic	115	845	Singapore 490; Indonesia 250.
Manufactured:			
Nitrogenous	--	31,102	Sri Lanka 30,900.
Phosphatic	--	260	All to Japan.
Potassic	--	225	Thailand 200.
Other including mixed	10	2	All to Singapore.
Ammonia	12	29	All to Hong Kong.
Graphite, natural	12,237	26,067	Japan 11,267; West Germany 6,181; United States 2,615.
Gypsum and plasters	3,420	54,817	Hong Kong 52,275; Indonesia 1,545; Singapore 610.
Iodine	--	17	All to France.
Lime	29,148	43,427	Hong Kong 43,074.
Magnesite	59,893	95,185	Japan 37,897; West Germany 19,546; United Kingdom 11,671.
Mica:			
Crude including waste	5,585	7,957	United Kingdom 6,110; West Germany 970; Japan 467.
Worked	12	19	Spain 6; United Kingdom 4; France 4.

See footnotes at end of table.

Table 2.—China: Apparent exports of selected mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
NONMETALS —Continued			
Pigments, mineral:			
Natural, crude	2,661	1,675	Hungary 1,395; Hong Kong 250.
Iron oxides, processed	2,599	2,730	Indonesia 780; Hong Kong 746; Singapore 607.
Precious and semiprecious stones:			
Natural value, thousands	$5,795	$5,809	Japan $1,482; France $1,431; United States $931.
Synthetic do.	$2	$103	Saudi Arabia $59; Switzerland $30.
Pyrite, unroasted	--	21	All to Saudi Arabia.
Salt and brine	165,286	184,704	Japan 143,807; Hong Kong 40,510.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	15,656	8,445	Hong Kong 7,749; Egypt 514.
Caustic potash	18	59	Jordan 50.
Soda ash	4,100	3,254	Hong Kong 2,815; Indonesia 266.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	35,586	46,668	Japan 44,541; Hong Kong 1,139.
Worked	18,115	21,937	Indonesia 6,309; Hong Kong 6,120; Japan 4,094.
Dolomite	--	500	All to France.
Gravel and crushed rock	58,159	14,804	Hong Kong 7,203; Japan 5,073.
Limestone	23,353	25,644	Hong Kong 25,194.
Quartz and quartzite	25,666	23,894	Japan 21,662.
Sand, excluding metal-bearing thousand tons	991	1,291	Hong Kong 1,239.
Sulfur:			
Elemental:			
Colloidal	NA	10	All to Sri Lanka.
Other than colloidal	28	1,100	All to United Kingdom.
Sulfuric acid	99	89	Hong Kong 85.
Talc	291,580	355,995	Japan 310,869; United Kingdom 10,738; Hong Kong 10,215.
Other:			
Crude	10,114	20,750	Hong Kong 9,940; Japan 3,793.
Slag, dross, and similar waste	22,846	3,707	Japan 3,000; Hong Kong 705.
Oxides of magnesium, strontium, barium	165	260	United States 108; Canada 72; Japan 40.
Halogens	NA	7	Trinidad and Tobago 5.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	r150	NA	NA.
Carbon black	155	270	Thailand 210; Hong Kong 20; Japan 20.
Coal including briquets:			
Anthracite and bituminous coal thousand tons	797	1,814	Japan 1,407; West Germany 132; France 71.
Briquets of anthracite and bituminous coal	--	509	All to Hong Kong.
Lignite and lignite briquets	1,219	649	All to Japan.
Coke and semicoke	--	12	Pakistan 10.
Peat and peat briquets	--	51	All to United States.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r67,758	71,915	Japan 53,498; Thailand 5,691; Brazil 5,059.
Refinery products:			
Gasoline do.	159	1,471	United States 711; Hong Kong 298; Japan 257.
Kerosine do.	1,902	2,914	Hong Kong 2,398; Japan 406.
Distillate fuel oil do.	6,658	11,069	Hong Kong 6,073; Thailand 2,578; Japan 1,665.
Residual fuel oil do.	1,672	2,909	Hong Kong 2,225; Singapore 569.
Lubricants do.	75	137	Hong Kong 97; Indonesia 18; Singapore 16.
Other:			
Mineral jelly and wax do.	r199	186	Pakistan 49; Thailand 44; Singapore 26.
Nonlubricating oils do.	31	137	Thailand 84; Indonesia 48.
Petroleum coke do.	979	1,362	All to Japan.
Bitumen and other residues do.	NA	8	Sudan 7.
Bituminous mixture do.	NA	17	Hong Kong 16.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,074	40,575	Japan 39,807; Hong Kong 621.

rRevised. NA Not available.

[1]Owing to the lack of official trade data published by China, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from various sources, which include United Nations information and data published by the partner trade countries.

[2]Data are compiled from official trade statistics of individual trading partners.

[3]May include some platinum or other platinum-group metals.

Table 3.—China: Apparent imports of selected mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Alumina	388	196	West Germany 105; Japan 61.
Metal including alloys:			
Scrap	r4,485	1,490	All from Egypt.
Unwrought	165,907	83,178	Canada 33,957; Australia 18,448; Norway 12,774.
Semimanufactures	5,477	4,447	Japan 2,477; Italy 850; West Germany 327.
Chromium:			
Chromite	r14,940	(3)	All from Turkey.
Oxide and hydroxide	13	153	All from Japan.
Cobalt oxide and hydroxide kilograms	2,025	50	Do.
Copper:			
Ore and concentrate, Cu content	r19,448	422,254	Philippines 8,159; Peru 7,697; Papua New Guinea 6,398.
Sulfate	4,395	2,205	All from Yugoslavia.
Metal including alloys:			
Scrap	121	81	All from Hong Kong.
Unwrought	r89,314	93,678	Peru 30,490;[4] Chile 30,400;[4] Zambia 20,626.[4]
Semimanufactures	311	2,040	Japan 1,814; Hong Kong 182.
Iron and steel:			
Ore and concentrate thousand tons	r6,198	6,042	Australia 5,709; Brazil 333.
Metal including alloys:			
Scrap do	r17	5	Mainly from Hong Kong.
Pig iron do	r968	620	Australia 417; Brazil 203.
Ferroalloys do	r57	69	Japan 27; Spain 15; Yugoslavia 10.
Steel, primary forms do	987	359	Japan 210; West Germany 80; France 37.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	2,296	2,826	Japan 1,379; West Germany 206; France 205.
Plates and sheets do	3,423	2,336	Japan 1,793; West Germany 240; France 72.
Hoop and strip do	246	216	Japan 152; West Germany 93; France 11.
Rails and accessories do	48	33	All from Japan.
Wire do	39	95	West Germany 24; Japan 24; Spain 13.
Tubes, pipes, fittings do	r1,277	1,627	Japan 770; West Germany 477; United States 178.
Castings and forgings, rough do	--	2	Mainly from Japan.
Lead:			
Oxide	108	1,763	All from Australia.
Metal including alloys:			
Scrap	--	72	All from Hong Kong.
Unwrought	23,983	534,987	Australia 22,490; Peru 10,494.
Semimanufactures	1	3	All from Belgium-Luxembourg.
Magnesium metal including alloys:			
Unwrought	999	4,643	All from United States.
Semimanufactures	--	252	All from Canada.
Manganese:			
Ore and concentrate	r29,717	NA	NA.
Oxide	826	702	Japan 701.
Molybdenum metal including alloys, all forms kilograms	5,059	229	All from Japan.
Nickel:			
Matte and speiss	115	--	
Metal including alloys:			
Unwrought	--	1	All from United Kingdom.
Semimanufactures	100	64	United Kingdom 32; Sweden 14; West Germany 11.
Platinum-group metals including alloys, unworked or partly worked value, thousands	$4,366	$9,731	United Kingdom $5,417; West Germany $2,039; Japan $1,691.
Silver metal including alloys, unworked or partly worked do	$49	$21	United Kingdom $19.
Tantalum metal including alloys, all forms kilograms	862	140	All from Japan.
Tin metal including alloys:			
Unwrought	2	6	All from Singapore.
Semimanufactures	--	2	Japan 1; Hong Kong 1.
Titanium:			
Oxide	1,219	1,400	Japan 1,203; Spain 100; Italy 91.
Metal including alloys, all forms	--	3	Mainly from France.
Tungsten metal including alloys, all forms	13	1	Mainly from Japan.
Zinc:			
Oxide and peroxide	78	989	France 580; United Kingdom 398.
Metal including alloys:			
Unwrought	5,158	52,098	Peru 1,999.
Semimanufactures	8	18	Italy 15.
Other:			
Oxides, hydroxides, peroxides	67	53	United Kingdom 40; Japan 13.
Metalloids	r5,158	5,769	Netherlands 4,006; France 1,031.
Alkali and rare-earth metals	--	4	All from United Kingdom.
Base metals, all forms, n.e.s	1	5	United Kingdom 4.

See footnotes at end of table.

Table 3.—China: Apparent imports of selected mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	--	1	All from Italy.
Artificial corundum	NA	4	All from West Germany.
Grinding and polishing wheels and stones	r102	25	Japan 15; West Germany 6.
Asbestos	296	1,269	All from Canada.
Barite and witherite	--	50	All from Thailand.
Boron oxide and acid	272	268	United States 168; Italy 100.
Cement thousand tons	167	457	Japan 456.
Clays and clay products:			
Crude clay	--	350	Belgium-Luxembourg 300.
Clay products:			
Refractory	1,461	2,163	Japan 1,871; West Germany 122; France 118.
Nonrefractory	679	684	Italy 674.
Diamond:			
Gem, not set or strung value, thousands	$4,158	$5,960	United Kingdom $5,563; Belgium-Luxembourg $374.
Industrial do	$4,253	$11,275	Belgium-Luxembourg $10,063.
Diatomite and other infusorial earth	282	--	
Feldspar and fluorspar	72	NA	NA.
Fertilizer materials:			
Crude, nitrogenous thousand tons	245	449	Morocco 168; Jordan 104; Egypt 71.[6]
Manufactured:			
Nitrogenous do	1,662	2,323	Japan 1,268; Italy 454; United States 226.
Phosphatic do	129	171	United States 86; Morocco 60; Tunisia 20.
Potassic do	207	421	Canada 322; West Germany 40.
Other, including mixed do	244	83	Italy 39; West Germany 31.
Ammonia	--	21	Italy 17.
Gypsum and plasters	18	--	
Magnesite	91	70	All from Japan.
Mica:			
Crude including waste	r75	3	All from United Kingdom.
Worked	r42	1	Mainly from United Kingdom.
Pigments, mineral: Iron oxide, processed	--	16	West Germany 14.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$340	$2,285	Switzerland $1,115; West Germany $1,103.
Synthetic do	--	$13	Switzerland $12.
Salt and brine	--	2	All from United Kingdom.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	57,932	130,856	Netherlands 61,288; United States 29,047; Spain 14,988.
Soda ash	28,250	NA	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	53	102	All from Portugal.
Worked	567	97	All from Japan.
Gravel and crushed rock	1	26	Japan 22.
Quartz and quartzite	--	20	All from Sweden.
Sulfur:			
Elemental, other than colloidal	205,235	250,538	Canada 244,138.
Sulfuric acid	3	1	All from Japan.
Talc	--	53	All from United States.
Other:			
Crude	3	41	United Kingdom 21; Japan 20.
Slag, dross, and similar waste	7	50	All from Singapore.
Oxides of strontium, barium, magnesium	52	54	All from Japan.
Halogens	53	80	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	NA	4,866	All from Trinidad and Tobago.
Carbon black	17,153	19,317	Japan 14,076; United States 5,041.
Coal: Anthracite and bituminous thousand tons	24	--	
Hydrogen, helium, rare gases	NA	4	Japan 2; Netherlands 2.
Petroleum refinery products:			
Gasoline 42-gallon barrels	3,298	11,807	All from Belgium-Luxembourg.
Kerosine do	15,632	10,749	All from Yugoslavia.
Distillate fuel oil do	1,485	8,609	Yugoslavia 6,035; Greece 1,798.
Residual fuel oil do	11,542	15,072	Yugoslavia 10,916; Greece 4,156.
Lubricants do	9,051	18,060	Japan 7,287; United States 4,452; Singapore 3,920.
Other do	992	5,815	Japan 5,373; Netherlands 236.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	24,214	21,687	West Germany 21,229.

rRevised. NA Not available.

[1]Owing to the lack of official trade data published by China, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from various sources, which include United Nations information and data published by the partner trade countries.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Value only reported at $2,651,000.

[4]World Bureau of Metal Statistics. World Metal Statistics, London.

[5]Metallgesellschaft AG. Metallstatistik, Druckerei C. Adelmann, Frankfurt am Main, 1980.

[6]The British Sulphur Corp., Ltd., Statistical Supplement, London.

COMMODITY REVIEW

METALS

Aluminum.—China's largest aluminum plant is a 100,000-ton-per-year smelter at Fushun, Liaoning. Smaller plants are believed to be located at Hefei, Anhui; Lanzhou, Gansu; Jiaozuo, Sanmenxia, and Zhengzhou, Henan; Wuhan, Hubei; Changsha, Hunan; Changchun, Jilin; Baotou, Nei Monggol; Nanding and Qingdao, Shandong; Taiyuan, Shanxi; and Kunming, Yunnan. In late 1979, Nippon Light Metal (NLM), Tokyo Bussan Co., Ltd., and C. Itoh and Co., Ltd., received a $150 million order for an aluminum plant and technology. Construction of the 80,000-ton-per-year smelter began on February 1, 1980, at Guiyang, Guizhou. Plant construction was under the technical guidance of NLM and was scheduled for completion in September 1981. The Government was considering a 600,000-ton-per-year plant in Guangxi and had approached the Aluminum Co. of America and Pechiney S.A. to provide technical assistance for this project, which was to cost $866 million.

Proven reserves of bauxite as reported by the Chinese were 1.1 billion tons of contained metal in deposits distributed in the east, southeast, and south-central China. Thirty-one bauxite deposits have been discovered in Shansi, which have an average alumina content of 65%.[17] Bauxite in Xiaoyi County reportedly contains as much as 73% alumina. An opencut mine, with an annual output capacity of 550,000 tons, was being constructed in the county. Bauxite deposits in the Province account for 26% of the total reserves in China.

In August 1980, a preliminary agreement was signed by the China International Trust and Investment Corp. and Minermet S.A. of Milan for the construction of a bauxite calcining plant in Henan Province.[18] Two rotary kilns will calcine bauxite from nearby Zhengzhou. The first kiln was to be delivered at the end of 1981, fired during the second half of 1982, and be in full production by yearend 1982. The second kiln was to go into production toward the end of 1983. Total output of refractory-grade bauxite was to be around 200,000 tons per year from both kilns.

Antimony.—China has large reserves of antimony and traditionally has been ranked as one of the three top world producers, along with the Republic of South Africa and Bolivia. The mines at Xikuangshan in Hunan are the largest producers in China. Antimony is also mined in Guangdong Province. A deposit in Sunyand County, in the Qinling Mountain Range, was reported to have reserves of antimony totaling 17,000 tons. Large antimony finds, which were described as of excellent quality, were reported in Qinghai, Sichuan, Tibet, and Yunnan.

Copper.—Reserves of copper in China were estimated at 50 million tons of contained metal. Notwithstanding, total annual production capacity was only 300,000 tons. Copper capacity of the smelter at Kunming was 45,000 tons per year and was to be expanded to 100,000 tons per year; at Shenyang, 50,000 tons per year; smelters No. 1 and No. 2 at Tongling, 60,000 tons per year (combined); and Zhu-Zhou, 10,000 tons per year.

Because of the increasing need for copper, China negotiated with Fluor Corp. to develop the copper at Dexing, Jiangxi. Sumitomo Metal Mining Co. was to build an integrated copper smelter at Guixi, also in Jiangxi, probably linked to the Dexing development. Work on the Guixi copper smelter reportedly began on July 30, 1980. First-stage construction consists of site preparation, infrastructure, and installation of whole equipment for the 90,000-ton-per-year smelter.[19] The Japanese were also to evaluate the expansion of the Tungshankou Mine near Tayeh, Hubei, and evaluate the Anjing Mine in Anhui. Three porphyry ore bodies were being developed or expanded at Yuangu, Shansi. A porphyry deposit containing 6.4 million tons of copper was reportedly found in eastern Xizong. In addition, there was a nickel-copper open pit prospect in Jinchang; copper-gold from Zhaoye in Shandong; and copper occurrences in Anhui.

Gold and Silver.—The Government reported that gold production in China hit an alltime high in 1981, registering a 14.3% increase over that of 1979.[20] There was increased output in all major gold-producing areas—Hebei, Heilongjiang, Nei Monggol, and Shandong. On March 1, the Government reportedly raised the price of gold purchased by State banks from 3.04 yuan per gram to 13 yuan per gram to encourage production and increase Govern-

ment holdings to finance capital investment for modernization.[21] Moreover, the Ministry of Geology was offering cash rewards for new finds. There were unconfirmed reports of racketeering and purchases by unauthorized persons, and smuggling because gold commanded a higher price on the international market.

Wright Engineers Ltd. of Vancouver was studying the feasibility of opening a gold mine and mill in Shandong to produce 500 tons of ore per day. The San Mateo office of Davy McKee Corp. was preparing a feasibility study to expand the Chio and Hsian Hsen gold mines near Wei Feng, overlooking the Yellow Sea in Shandong. The Davy McKee study included building one or two bullion plants, and a possible solution for the problem of proper backfilling. Less than 5 tons of gold per year could be produced from the Wei Feng mines.

Two gold mines, described as large, were opened and started operations in Shandong—Xincheng Mine and Jiaojia Mine. Three ore-dressing plants, with ore-processing capacities of 500 tons per day, and several small dressing plants were also in operation in the area.

Construction continued on one mine and three ore-dressing plants in Henan to produce 100,000 ounces of gold per year. The largest deposit contained reserves estimated at more than 30 tons of gold. A large placer gold deposit was reported in the valley along the Yuehhe River in Shaanxi. Gold in this deposit was associated with ilmenite and garnet.

A large silver deposit was discovered in Henan. The silver content was reported to be 300 grams per ton of ore. A silver lode with reserves of 250 tons was discovered in the Miyun Mountain area, northeast of Beijing. Chinese silver output is obtained mainly as a byproduct in the processing of lead and tin.

Iron and Steel.—China's total annual capacity to produce steel was around 37 million tons.[22] Anshan and Benqi iron and steel complexes are in the northeast. The integrated facility at Anshan produces about one-fifth of the national output. In north China, there are iron and steel works at Beijing, Tianjin, Tanggu, Taiyuan, and Baotou. In east China, there is Shanghai and Maanshan. In south-central China, there is Wuhan, and in the southwest, Panzhihua. Combined, these iron and steel enterprises account for about 86% of China's annual steel production. With the exception of Shanghai, all the major complexes are located near indigenous supplies of coal and iron ore. Singularly, Shanghai is the only plant with a coastal location.

Additionally, smaller iron and steel plants exist in every Province and autonomous region, with the exception of Xizang. These smaller units have collectively an annual production capacity of 11 million tons of iron; and 6 to 8 million tons of steel and steel products. The Chinese estimated that the combined output capacity of the smaller units could be increased by 3 million tons through innovation and improvement. By increasing efficiency, the major enterprises could also collectively increase annual output by 10 to 12 million tons. On the basis of practical improvements and the inclusion of the projected new capacity for the Baoshan integrated complex (6 million tons per year), China's production potential is 55 to 58 million tons.

During 1979, Chinese planners were assessing and reevaluating the country's modernization program. Industrial productivity and output levels were examined critically. By late 1979, veiled pronouncements were being made on emphasizing readjustment in the four modernization keywords. Finally, the Government announced that agriculture and light industry were to be the prime sectors for development. Inflation and lack of foreign currency presumably caused the retrenchment from developing heavy industry—capital intensive—to light industry. The latter required less monies to produce volume exports to gain earnings. Development of energy resources—coal, petroleum, and natural gas, however, retained high priority.

Iron and steel, and other heavy industry, were to support agriculture and the light industry sectors. Capital investment retrenchment in the iron and steel industry was deemed necessary. Although China had large reserves of iron ore (44 billion tons), this was inadequate in light of the low grade. Among the large iron and steel bases, only about 40% of the capacity could be self-sufficient without relying on ore imports. China imports iron ore principally from Australia and North Korea for blending to upgrade domestic ores. Moreover, the critique continued, many of the smaller iron and steel industries could not be self-sufficient. Domestic mining was characterized as difficult and slow in yielding result and return on investment as well as requiring more efficient technology, better mining

equipment, larger investment capital, and long construction periods.

The technology and equipment for steel rolling was described as quite backward as well as insufficient to meet demand. Additionally, the flexibility to regulate mill varieties was also very limited, and output lines failed to meet product specifications. Rather than increase steel output, steel-rolling output capacity and technology should be improved. Furthermore, metal scrap utilization should be enlarged if possible to lower pig iron consumption, and to reduce energy consumption.

During the past 20 years, total investments in the iron and steel industry reached 53 billion yuan or 8.9% of total domestic investment in capital construction. This was far higher than the 5.4% for light industry. Results were deemed quite poor, particularly during the second 5-year plan, when investments in heavy industry rose to 14%.

Energy consumption by China's iron and steel industry was more than double the average world consumption. Because of the present shortage of coal and electricity, a number of Chinese enterprises were criticized and many could not maintain operations. For the production of 1 ton of steel, China needs about 2.5 tons of standard fuel, compared with 0.8 tons for Japan, 0.9 tons for the Federal Republic of Germany, 1.0 tons for the United States, and 1.2 tons for the U.S.S.R. The utilization of residual heat was very low. Additional criticisms involved irrational selection of sites, no seriated enterprises, but rather discrete competitive enterprises, and increased costs as a result of poor integration.

The Baoshan iron and steel project originally was to be completed in two stages—capacity of 3 million tons to be completed in 1982, and the remaining 3 million tons to be completed in 1985. In November 1980, the Government announced the suspension or delay for implementing construction on the second phase. By yearend, there were doubts whether the first stage of construction was to continue. Work, however, was to continue on the coal-fired powerplant at the site. Baoshan is located outside of Shanghai on the Chiang Jiang River, and access by road is difficult. To secure the foundations, it was necessary to drive 100,000 piles into marshy ground. Bulk material will have to be transported by river to service the site; however, 100,000-ton bulk carriers cannot navigate the channel to Baoshan. A new port was to be built near Ningbo, south of Shanghai, in Zhijiang. At Ningbo, ore would be transferred to smaller vessels for the 130-mile distance to Baoshan where a new receiving port was to be built. Another problem was potential movement of a large sandbar north of the port and potential problems with heavy silting. In light of the shortcomings and the readjustments in the modernization program, China was expected to announce in early 1981 a decision on the viability of the Baoshan project.

Lead and Zinc.—In 1980, the Beijing Central Engineering and Research Institute for Nonferrous Metallurgical Industry reported that the proven reserves for lead ore was 20 million tons of contained lead, and for zinc ore, 53 million tons of contained zinc.[23] The lead and zinc ores were widely distributed and were notably in the southwest, south, central, and northwest. The country's primary refined lead and zinc production capacity were each approximately 250,000 to 300,000 tons per year.[24] The rated annual capacity of the smelter at Shaoguan was 12,000 tons; Shenyang, 50,000 tons; and Zhu-Zhou, 50,000 tons. For the principal zinc smelters, the capacities were Huludao, 60,000 tons; Shaoguan, 30,000 tons; Shenyang, 20,000 tons; and Zhu-Zhou, 100,000 tons.

The largest lead-zinc mine is at Fankou, Guangdong; reserves are estimated at 30 million tons of combined lead-zinc. Metal recovery was to be expanded to 150,000 tons annually by 1981. Current output was around 1,500 tons per day of ore or less. Some lead ore is produced at Shuikoushan in Hunan and at a mine not far from Liencheng in Liaoning. There were a number of small mines in Liaoning, and some lead and zinc is mined at Sidin in Guangxi. A multimetal mine and extraction plant was being constructed at Changpo, Guangxi. In addition to tin and antimony, annual zinc output would be 20,000 tons, and lead, 5,000 tons. There were also plans to develop a mine at Houdong near the Yunnan border and construct a 100,000-ton-per-year zinc refinery.

A high-grade ore discovery was found in Gansu, with proven reserves of 7 million tons of lead-zinc. Announcements of other significant deposits included lead (associated with tin) in Guangxi; zinc deposits in Guangxi, Xizang, and Yunnan; and lead-zinc in Gansu, Sichuan, and Yunnan.

Nickel.—Jiuquan in northern Gansu was the largest nickel-producing center in

China.[25] The nickel mine was described by the Chinese to be the second largest deposit (after Canada) of nickel sulfide in the world. Jinchang began producing electrolytic nickel in 1964; the industrial center has a population of 50,000 which is supported by mining, smelting, power and construction industries, and research facilities for science and technology. In addition to nickel, Jinchang produces gold, silver, copper, and cobalt.

Rare-Earth Minerals.—Based on a Chinese geologic survey completed in the early 1950's, China purportedly had more than one-half of the world's reserves of rare-earth minerals. As noted in *Rare Earths*, a 1978 publication of the Ministry of Metallurgy, China has vast reserves of rare-earth minerals, 98% of which are in Nei Monggol.[26] Large occurrences are found also in more than one-half of China's Provinces and autonomous regions. China also has the world's greatest variety of rare-earth-bearing minerals, some of which are unknown elsewhere; these minerals contain nearly every important rare-earth element.

The Bayan Obo Mine in Nei Monggol is the country's major producer of rare earths. Yttrium is produced, as well as some scandium.[27] The Bayan Obo Mine has been decribed as probably the largest samarium mine in the world.

Southern Jiangxi has rich rare-earth resources. Ganzhou prefecture has seven proven deposits of good-quality rare earths in tracts large enough to be strip mined.

China began producing rare-earth products in 1958 and now manufactures more than 200 products. Chinese exports of rare earths began in 1978.

Tin.—China's total tin metal production in 1980 was reported to be 14,600 tons.[28] The Kokiu smelter (south of Kunming) of the Yunnan Tin Corp. is the largest tin smelter in China, with a rated annual capacity of 20,000 tons. The smelter is about 70 years old and currently produces around 10,000 tons per year of four grades of metal. Local ore is concentrated to 43% tin by several concentrators within a 30-kilometer radius of Kokiu, and then transported by truck to the smelter. There are seven reverberatory furnaces used for smelting and slag treatment. Two modern furnaces are fired with powdered coal burners and the other by burning coal on fixed fire grates.

The Linchou smelter in Guangxi was put into operation in 1953 and currently produces 2,000 tons of metal annually. Incoming tin concentrates assaying 45% to 50% tin come mainly from the Da Chang Mine. The Guangghou smelter in Guangdong and the Ping Gui smelter in Guangxi each produce about 1,000 tons of metal annually. Concentrates used by the Guangzhou smelter are high in sulfur and arsenic and require roasting before charging by two electric furnaces. Crude tin is cast into anode for electrolytic refining. Ping Gui smelter lacks roasting equipment and also uses concentrates which are high in sulfur and arsenic (between 1% and 3% each).

There are two small smelters in Guangxi. Limo smelter produces 400 tons of tin per year from concentrates high in tungsten, tantalum, and columbium. The Kandro smelter, also in Guangxi, and the Hingyang smelter in Hunan, each produce 100 tons of metal per year as a byproduct of other metal refining. Construction of a 6,000-ton-per-year smelter was proposed for Leipin County, Guangxi.

Tin mine output in Yunnan was from six alluvial deposits and five underground mines. Tin mineralization in Liaoning is in skarn deposits. Output in Fuhochung, Guangxi, is from placer deposits. The first stage of construction of a tin-mining/ore-dressing complex in Hichih, Guangxi, was reportedly completed. This placer operation was expected to produce 4,000 tons per year of tin, as well as significant quantities of zinc, lead, antimony, and some precious metals.

Tungsten.—China's most significant tungsten occurrences are wolframite mineralization in the Nan Ling Range in Jianjsi. Mining is currently from Dajishan, Gueimeishan, Pankushan, and Xihuashan. However, scheelite deposits in Hunan were becoming more important. Significant deposits also occur in Guangdong, Fujian, and particularly Guangxi. Because of large reserves, tungsten in Guangxi was designated to be a key project of the metallurgical industry. Presently, output from tungsten mining at Donxing, Lingma, and Mashan was used for export. There have been numerous citations for new tungsten finds in China, notably in Guangxi, Tianji, Xizang, and Yunnan.

Uranium.—Although China has demonstrated nuclear capability, it was believed that present technology was limited in uranium enrichment. Neither the production level nor total reserves are known. However, one Western source placed annual uranium production at 1,000 tons of 0.125% ore.[29]

More than 10 uranium deposits have been developed and mined in northern Guang-

dong.[30] A large uranium concentration occurs in a fracture stratum of Mesozoic granite.[31] The radioactive belts were in the Huagang Crag stratum, Tan Mutao, in the Nan Ling Mountains. The Yenshan granites showed pronounced differentiation in uranium content, and the uranium was gradually enriched from the older to the younger rock. In the most recent fine-grained binary granite, the uranium content is six times higher than in the oldest granite.

Uranium was reportedly found in northeast Liaoning, occurring in geologic formations that date back 2 million years. Technical data from this find were being used to prospect other uranium occurrences in similar formations.[32]

The Marine Resources Chemical Research Institute of Shanghai Normal University was continuing its research in uranium extraction from seawater.[33] The institute was cited in 1970 for extracting 30 grams of uranium from seawater. Later, it won a prize at the 1978 National Scientific and Technology Conference for its achievements in uranium extraction.

Other Metals.—The Ministry of Geology reported that China had a large variety of minerals, as well as sufficient reserves of important minerals, for the country's economic development in the 1980's.[34] However, much of China's reserves were contained in associated mineralization in complex ores, especially in Nei Monggol. There was significant recovery of vanadium from the titaniferous magnetite in Panzhihua; vanadium was also being recovered from coal tailings. Large quantities of vanadium were exported, principally to the United States, and in 1980, 88,184 pounds of vanadium pentoxide was shipped to the United States. China was also producing titanium sponge, and in 1980 both sponge and ingot were available for export. Arsenic, molybdenum, and cobalt were recovered as byproducts in copper-nickel smelting and refining. Magnesium metal is produced electrolytically and by the thermic process; small quantities of beryl were shipped to the United States, and high-purity silicon was available for export. The country is a well-known producer of mercury. China is also known to produce tantalum and columbium. Following the ratification of a raw materials exploration agreement, investigators from the Federal Republic of Germany were to conduct a tantalite-columbite exploration in Hunan. Other metals produced in China included gallium, germanium, indium, lithium, and zirconium.

NONMETALS

Barite.—Notwithstanding the increasing domestic consumption of barite for oil and gas drilling, China's output of barite increased sufficiently enough to permit a larger volume of exports. Apparent exports in 1978 were around 150,000 tons, more than double in 1979, and over 500,000 tons in 1980. Principal destinations were the United States, Japan, Netherlands, and the Federal Republic of Germany. In 1980, United States receipts of Chinese barite were 469,000 tons.

K.C.A. Feoso (KCAF), a joint venture of K.C.A. International and Feoso Oil Ltd., signed an agreement with China National Metals and Minerals Import and Export Corp. in which KCAF would finance, design, and build a $3.5 million barite processing plant in Guangxi.[35] The proposed plant will have two 11-ton-per-hour mills. KCAF agreed to buy 140,000 tons of barite before the plant goes onstream in 1981 and will acquire first purchasing rights for barite produced over a 10-year period. The company will use the barite in its existing oil operations in the United Kingdom, Venezuela, and the Far East, and will sell any surplus on the open market.

Reserves of barite in Hubei were estimated at approximately 20 million tons.[36] The deposits were scattered throughout seven counties.

Cement.—On January 1, 1980, China officially adopted new cement standards which were formulated by the country's National Bureau of Standards.[37] Research and formulation for revising standards for portland cement, blast furnace slag cement, pozzolan cement, and fly-ash cement began in 1972. A total of 75 cement concerns from 24 Provinces, municipalities, and regions participated in the task force.

There were seven principal revisions in the cement standards. First, clinker cement and portland fly-ash cement were added to the existing classification. Second, in slag cement, slag blend was revised to 20% to 70% from 20% to 85%. Either pozzolan or fly ash, or a mixture thereof, was permitted to be substituted for the slag—substitution not to exceed one-third of the total amount of the material added or 15% of the total volume of water. The limits for fly ash in fly-ash cement was to be between 20% and 40%. In both pozzolan and fly-ash cement, up to one-third of the total volume of material blended may be slag. Third, the plastic-mortar method was to replace the

earth-drying method for testing cement strength. Fourth, the amount of magnesia in clinker has been revised not to exceed 6% from 4.5%. When between 5% and 6%, autoclave soundness testing must be conducted. Fifth, sulfur trioxide content in cement was revised from 3% to 3.5%. For slag cement, it was not to exceed 4%. Sixth, in addition to the dry-sieve method, the water-sieve method was added for testing fineness. Seventh, sand from Pingtan in Fujian Province was to be the standard sand. Ignition loss was revised from 0.3% to less than 0.4%; silt-carrying capacity was revised from less than 1.0% to 0.2%; and fineness was to range 0.25 to 0.65 millimeters.

About 66% of the country's annual production capacity was comprised of 3,400 plants which are not part of the unified State distribution system.[38] Most of these plants use vertical kilns. About 120 of the 3,400 plants have annual capacities in excess of 80,000 tons; 280 with 40,000 to 80,000 tons; and the remainder, less than 40,000 tons. About 1,000 plants, run by communes and brigades, have an average annual production capacity of about 2,000 tons. Forty-nine plants comprise the remaining third of China's cement output capacity. During 1980, 25 cement works, with a combined annual capacity of 9.6 million tons, were reported under construction by the Ministry of Building Materials. These included the Baimashan cement works in Anhui Province (500,000 tons per year); Changxing cement works in Zhejiang (450,000 tons per year); Litang cement works in Guangxi (500,000 tons per year); and Qujiang cement works in Sichuan (460,000 tons per year). In addition, there were two whole plant imports from Japan (each with a total annual capacity of 1.5 million tons) and one from Romania (1 million tons). Most plants were to be completed and operational in 1983.

Coal accounts for about 88% of the energy supply for China's cement industry, and oil and natural gas account for the remainder. In order to conserve energy, efforts were being made to develop and use large rotary kilns with cyclone preheaters or precalcining burners.

Fertilizers.—Despite the imports of chemical fertilizer plant installations since 1973, China continued to be a large importer of fertilizers. Nitrogenous fertilizers were imported from Italy, Japan, Morocco, and the United States; phosphatic fertilizers from Morocco, Tunisia, and the United States; and potassium fertilizers from Canada and the Federal Republic of Germany. Domestic production included nearly 10 million tons of nitrogenous fertilizers, 2.3 million tons of phosphatic fertilizers, and only 20,000 tons of potash. The varieties of chemical fertilizers produced include single sulfate of ammonia, urea, ammonium nitrate, ammonium bicarbonate, ammonium chloride, lime, nitrogen, calcium phosphate, and calcium magnesium phosphate. Also, there is small-scale production of ammonium phosphate; potassium nitrate; and potassium, borate, molybdic, and copper microelement fertilizers. Jacobs International of Dublin was negotiating the construction of a large fertilizer plant at Qarhan Lake in Qinghai Province.[39] The dry lake basin covers an area 100 miles long by 40 miles wide and was estimated to have 200 million tons of potassium-rich salt reserves.

Fluorspar.—China has been an important producer and exporter of fluorspar for several decades. The leading producing Provinces were Fujian, Hunan, Liaoning, Shanxi, and Zhijiang, with some from Guangdong and Shangdong. In the 1960's, large tonnages were exported to the U.S.S.R. and Japan, and more recently only to Japan which imported close to 225,000 tons in 1980. Reportedly, only small quantities of very high-grade lump fluorspar were shipped to U.S. producers recently on a trial basis for testing, and in 1980, exports to the United States totaled 24,660 tons. Chinese fluorspar, in lumps or fines, were available in specifications from 70% to 95% minimum calcium fluoride, with maximum silica ranging from 4.5% to 29%.

Gem Stones.—The Ministry of Geology reported that 30 varieties of jade and other precious and semiprecious stones were found during 1980 at 165 locations in 10 Provinces. Preliminary surveys showed that some deposits of sapphires, aquamarine, amethyst, amber, tourmaline, and topaz may be workable. Malachite, agate, and other precious stones were found in a dozen localities in Xinjiang. Sapphire was found in a 300-square-kilometer area in Fujian. In 1979, the Ministry had trained more than 100 people to look for gem stones.[40]

Magnesite.—Most of the magnesite mined in China is from Da Shih-Qiao, Liaoning Province. At Da Shih-Qiao there are two mining sites, a mechanical shaft kiln, and a rotary kiln plant. Mine site No. 1 has an annual capacity of 1 million metric tons,

and mine No. 2 has a capacity of 2 million metric tons, compared to current output of 600,000 to 700,000 tons and 1 million tons, respectively. After blasting, magnesite chunks measuring 4 to 5 feet in size are crushed by a jaw crusher to a 1- to 4-inch size. The ore going for rotary kiln calcining is further crushed in a dry pan to 1 inch and finer. Crushed ore is stored in silos at the mine site, and later moved about 6 miles by railroad to the calcining plant. Upgrading before calcining is unnecessary because of the purity and consistency of the magnesite. Both shaft kilns and rotary kilns at the calcining plant are used for dead-burning the magnesite. There are five steel vertical shaft kilns, each producing 80 tons of dead-burned magnesite per day. In addition, there are two 198-foot-long rotary kilns, with 12-foot internal diameter; each kiln produces 200 tons of dead-burned magnesite per day.[41]

Salt.—Production of salt in China has averaged 17 million tons annually since 1977, but this probably does not include salt production used in the production of industrial chemicals. Liaoning Province is one of the country's major salt producers and has more than 60,000 hectares of saltfields along the Yellow and Boahi Seas. China's largest saltfield is at Tanggu near Tientsin. Other major salt-producing areas were in Shandong, Jiangsu, Guangdong, Sichuan, and Hainan. Most of the country's output was from solar evaporation ponds and evaporites in dry salt lake beds.

The largest salt deposit in China was reported in the Qaidam Basin in Qinghai, with reserves sufficient to satisfy the entire population for 10,000 years.[42] The most famous salt-producing areas in China historically were along the Hai He which runs through Anhui, Henan, and Hunan Provinces.[43] The salterns in Huaibei (translates as the north banks of the Hai He) are protected by a 200-kilometer-long dike. Six chemical plants were built in the area to utilize waste brines of the salt-producing process to recover potassium chloride, magnesium chloride, bromine, anhydrous mirabilite, and magnesium metal. The plants also produce compounds for chemical fertilizers.

In the Ih Ju Meng area of Nei Monggol, two-thirds of the Hanggin Qi salt lakes were being covered over with sand. This deposit, opened to mining in 1951, was estimated to contain 5 million tons of salt and 30 million tons of saltpeter. Because of sand intrusion, annual production of salt decreased from 24,000 tons in 1974 to 4,200 tons in 1977, and was expected to become a wasteland unless prompt and effective measures were used to save the field.[44]

At the saltfields along the shores of the Yellow and Bohai Seas, about 1.2 million cubic meters of bittern was produced annually. In the effort to increase product quality for salt and minimize pollution, mine plants (including the newly expanded Piziwo plant) in the area were processing about 55% of the bittern generated from salt production. Compounds recovered from the bitterns included potassium chloride, magnesium chloride, and bromine.[45]

The Japan Soda Industry Association reported that China could become a reliable supply of salt raw materials and has sufficient capacity to export 1 million tons of salt annually.[46] Moreover, the quality of the salt from Huaibei has improved. However, with the exception of Tianjin, salt exports were hampered by inadequate transportation and harbor facilities. The Chinese felt that these hindrances could be overcome on the condition that a large export market existed and was stable.

Other Nonmetals.—Prior to 1950, only a few nonmetal ores such as pyrites and phosphates were mined. To date, however, China has claimed 80 deposits of sufficient reserves for nonmetal minerals. Aside from magnesite, dolomite, limestone, and salt, the most abundant were alum, arsenic, gypsum, phosphate, and pyrites. Phosphate occurrences were found in almost every Province, with three-fourths of the reserves concentrated in Guizhou, Hubei, Hunan, Sichuan, and Yunnan. The second-order minerals—which were present in important amounts—included barite, bentonite, diatomite, graphite, kaolin, mirabilite, perlite, talc, and zeolite. High-quality asbestos occurs in Shaanxi and Sichuan. Graphite[47] is found in Xinjiang, Heilongjiang, and Shandong, as well as Hubei, Jilin, and Shanxi. Kaolin occurs in Jiangsu, and kyanite in Shanxi. Sodium bentonite occurs in Julin, Xingjiang, and Zhijiang, and a new deposit was found in Sichuan. Seventy percent of China's mica reserves are reportedly in Xinjiang. There are four active mines and three processing plants in the area, with a total output of 1,140 tons. China also has large quantities of high-quality marble. While there are vast resources in dry lakes, potassium production is small. Similarly, diamond mining is small scale. China's

largest boron mine went into operation midyear 1980.[48] The open pit mine, located in Yingkou, Liaoning, has high-grade ore and was expected to have an annual output of 100,000 tons of boron.

MINERAL FUELS

China's principal energy resource was coal which accounts for about 71% of its energy resources. Petroleum and natural gas account for 21%, and hydropower accounts for about 3%. Government planners anticipated little change in the country's energy supply configuration for the next 20 years. Under an energy program, newly formulated coal and hydropower development will occupy a priority position. However, petroleum and natural gas will naturally not be excepted.

China's confirmed hydropower resource was estimated at 677 million kilowatts. Within the next decade or two, the key hydropower developments are to include 10 large-scale projects on and along the upper reaches of the Changjiang and Huanghe, and the Yaliongjiang. Construction in progress during 1980, with a total capacity of 9,200 kilowatts, included plants at Lubuge (600 kilowatts) and Tianshenggiao (800 kilowatts) on the Hongshishe on the upper reaches of the Zhujiang; at Longyangxia (1,500 kilowatts) on the upper reaches of the Huanghe; at Wuqiangxi (1,750 kilowatts) in western Hunan; and at Gezhouba (2,710 kilowatts) on the Changjiang. Those planned to be built during the sixth 5-year plan have a combined capacity of 20,000 kilowatts, and those to be built in the seventh 5-year plan have a combined capacity of 40,000 kilowatts.

Coal-fired thermal plants were to be built by constructing clusters of power stations near coal mining districts. During the next decade or two, 10 thermal power bases were to be constructed in various mining districts, including Helanshan, Helinhe, Lianghui, Liupanshui, Lunan, Mengnan, Shanxi, Shuzhou, Weibei, Yimin, and Yuxi. Projects under construction in 1980 included Datong No. 2 (1,200 kilowatts) and Shuxian (1,350 kilowatts) in Shanxi; Huibei (750 kilowatts) and Huinan (600 kilowatts) in the Lianghui area; Shilicuan (500 kilowatts) in Lunan; Pindingshan (1,800 kilowatts) in Yuxi; and Qingling (800 kilowatts) in Weibei. Preliminary plans for the 1990's include construction projects totaling a capacity of 70,000 kilowatts.

Around 1990, two nuclear powerplants were envisioned in the southeast. Concomitantly, energy conservation and the elimination of energy waste was extremely important to ease fuel and power shortages and to guarantee continued growth of industry.[49]

The use of biogas (methane from organic matter) is extensive throughout rural China. It was estimated that there were 17,000 production brigades in 21 counties in the country which produce methane from biogas digesters. In Sichuan alone, there were 5 million methane-generating ponds, 500 methane gas power stations (total power capacity of 5,500 horsepower), and 300 electric power generating stations using methane gas (total generating capacity of 1,500 kilowatts).[50]

Coal.—China's resources of coal were estimated at 1.5 trillion tons, of which 600 billion tons are confirmed reserves. China ranks third, behind the U.S.S.R. and the United States, in terms of overall resources.

Since 1978, China's annual output has averaged close to 625 million tons. Mining bureaus with an annual production of more than 10 million tons were Datong, Fengfeng, Fushun, Fuxin, Hegang, Huaibei, Jixi, Kailan, Pingdingshan, Xuzhou, and Yangchuan. Annual production at Datong, Fushun, and Fixin is each probably around 20 million tons. Bureaus with an annual output of 5 to 10 million tons were Huainan, Jiaozuo, Shihuijing, Shuangyashan, Tongchuan, Tonghua, Xinwen, Xishan, and Zaozhuang.[51]

Most of the coal mined is north of the Changjiang River in the central, north, and northeast regions of the country. About one-half of the national output is produced in the north and northeast. Shanxi alone accounts for about one-sixth of the total annual production. The central Provinces of Anhui, Henan, Jiangsu, and Shandong contribute about one-fifth of the national production.

China's newly formulated energy program emphasized the equal need for energy development and conservation. Conservation was given a priority position for the immediate future, and coal development was a long-term priority. Under the coal development program, existing mines were to be improved and modernized. Mine output was to increase gradually as a result of mine mechanization. County-operated regional mines were to be consolidated to increase efficiency and productivity, and to be technically improved (these mines produced a total of 278 million tons in 1979).

Currently, improvements were being made in 1,200 local mines.

After discussing a long-term plan for developing Shanxi's coal industry, Government planners decided to turn the Province into a major energy base for the country. Coal occurs in 70% of Shanxi's counties, and the Province's large deposits make up one-third of the Nation's total reserve. One-half of the Province's reserves is high-grade coking coal. The reserves are easily accessible, lying 300 to 400 meters underground. Smaller investment was needed for development and extraction because the coal seams were stable, simple structures. Coal transport from Shanxi to neighboring markets outside the Province is relatively convenient. Moreover, Shanxi already had a number of well-equipped coal bases which supplies about one-sixth of the Nation's production.

A pair of shafts, with a designed capacity of 4 million tons per year, was being built at Datong where 23 million tons of coal was produced in 1979. In addition, old pits at Datong were being mechanized. In April 1980, agreement was reached for six Chinese-Japanese joint coal development projects in Shanxi. These were as follows, with annual capacity given in million tons and coal type: Xiqu (3, feitan and coking); Malan (4, feitan and coking); Zhenchengdi (15, feitan and coking); Jining No. 2 (4, steam); Tunlan (4, coking); and Guishigou (3, coking). Construction on Xiqu and Zhenchengdi was to be completed in 1984; on Malan in 1986; no date was set for the others.

The new Huolinhe coal base on the Horqin grassland in Nei Monggol was designed with technical assistance from the Federal Republic of Germany. When completed in 1985, this coal base will produce 20 million tons per year and will become one of China's largest open pit mines. To be automated, Huolinhe will use advanced, continuous mining technology throughout the production process. Japan was to participate in the construction of a mine at Jungar. Proposed output of steam coal for this mine was 10 to 20 million tons annually and was to be completed in 1990.

Large Chinese-made drills were being used in the construction of seven pairs of shafts at the Huainan-Huaibei coal base in Anhui. The total designed capacity for this expansion was 14 million tons per year. A 3-million-ton-per-year steam coal mine at Panji, Anhui, was to be completed in 1985 with Japanese participation.

Construction was being accelerated at Yanzhou in Shandong, and at the Xuzhou base in Jiangsu on the construction of seven pairs of shafts and four coal dressing plants capable of producing 14.7 million tons of coal per year. Japanese assistance was obtained for developing two mines in Shandong. The steam coal mine at Baodian was designed for a 2-million-ton-per-year output and was to be completed in 1984. A 1.5-million-ton-per-year mine at Jiangzhuang for steam coal and feitan was also to be completed by 1984.

The Liupanshui base in Guizhou was being expanded as a major source of coal supply for the steel industry in southwest China. Its present annual capacity is 10 million tons. Two new mines were under construction, with an annual designed capacity of 1.2 million tons and 0.6 million tons, respectively.

Construction of four pairs of shafts, with a total annual capacity of 12 million tons, was nearing completion at Pingdingshan in Henan and Kailuan in Hebei. A 3-million-ton-per-year mine for brown coal was to be developed with Japanese assistance at Yiminhe in Heilongjiang. The mine (coal output was to be used domestically) was scheduled for completion in 1985.[52 53 54]

Petroleum and Natural Gas.—Development of China's petroleum and natural gas resources was still at an early stage. Within China's territorial limits, there is an area of more than 4.2 million square kilometers of sedimentary rock out of 9.6 million square kilometers of the Chinese land mass and more than 1 million square kilometers of the Chinese Continental Shelf with potential oil-bearing prospects. Prospecting has not been done in most areas, or only insufficient studies have been conducted. In places where prospecting has been completed, some authorities feel drilling has not been done to sufficient depths.

There are more than 160 oilfields under exploitation. In 1979, China's crude oil output ranked fifth in the world. Natural gas output amounted to 14.5 billion cubic meters. Production levels for petroleum and natural gas in 1980-81 were to remain substantially at the 1979 level.

Most land prospecting focused on deep wells in eastern China. However, there were plans to intensify oil drilling in the west. Exploratory drilling in the sedimentary pans in Tsaidam, Tarim, Zhunkan, and in the Shaanxi-Gansu-Ningxia area indicated fair prospect for oils.

Offshore developments had more promising prospects. During drilling in the Pearl River Basin on the Continental Shelf off the South China Sea, No. 7 well brought in crude oil. At the South China Sea-Northern Continental Shelf-Fossil Stratum Conference convened in Guangzhou in early 1980, Chinese experts agreed that the South China Sea had potential for oil development.

Between May and July of 1979, China signed agreements with 16 petroleum companies in the United States, the United Kingdom, France, and Italy for seismic surveys. These surveys were contained in eight areas along a line extending 100,000 kilometers in the South China Sea and the southern Yellow Sea, encompassing a total area of 110,000 square kilometers. The surveys were completed in July 1980, and the concerned parties were interpreting and evaluating the seismic data. The Chinese were optimistic about developmental prospects in the area.

There were reports that 20 wells were drilled in the offshore area close to Zhanjiang and that there were gas or oil showings. Oil and natural gas were also believed to have been found in a strike in the Gulf of Tonkin. Other reports concerned large oil and gas finds north of the Yangzi in eastern Jiangsu—26 wells drilled in the southwest Qaidan Basin in Qinghai, 20 of which were reported to have showed oil and gas; a gasfield near Sanshiu in Guangdong; and continued exploration in Ta Li Mu Basin in Zinjiang and gasfields in eastern Sichuan.

Two fields were in the developmental stages. One was along the lower reaches of the Yellow River which produced low sulfur crude, and the other is the Liaohe Field in northeast Liaoning. The Liaohe Field has eight oil-producing districts, with 1,800 wells and 160 stations for collecting, transporting, and measuring oil and gas. Liaohe produces 5 million tons of crude oil and 1.7 billion cubic meters of gas annually.

By mid-1980, China was concluding exploration and development contracts with foreign partners. The first was with Japan-China Oil Development Corp., a subsidiary of the State-owned Japan National Oil Corp. The area included in this contract covered about 25,000 square kilometers of the western and southern parts of Bohai Gulf and may include some onshore area. The other partner was the Société Nationale Elf Aquitaine, which was granted a 9,000-square-kilometer area in the central and eastern section of Bohai; Compagnie Francaise de Pétroles was granted a 10,000-square-kilometer area in Beibu Gulf.[55]

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The Mineral Industry of Colombia

By Doris M. Hyde[1]

Colombia experienced somewhat slower economic growth in 1980 than in previous years. The gross national product (GNP), estimated at $32.2 billion[2] at current prices, grew in real terms by 4.5% in 1980 compared with a 5.4% growth rate in 1979. The rate of inflation fell from almost 29% in 1979 to below 26% in 1980. The peso devaluation increased to about 16% in 1980, reducing somewhat its cumulative overvaluation, as well as helping to maintain the competitiveness of minor and nontraditional exports.

The mineral industry remained dominated by the production of mineral fuels and the precious metals, gold and platinum. Natural gas production increased in 1980, with production averaging an estimated 7% above that of 1979. The late 1979 completion of a pipeline linking Texaco Oil Co.'s offshore Chichupa Field and the main line to Cartagena contributed to the increased production and consumption of natural gas. Petroleum production showed a slight gain in 1980, and although it is probably too soon to presume a complete reversal of Colombia's gradual production decline, it at least indicates that the persistent downtrend has been stemmed. Gold production in 1980 was estimated to have increased 87% over that of 1979. As a result, Colombia has regained its rank as the second largest gold producer in Latin America after having dropped to the third position when full-scale gold mining began in the Dominican Republic in 1976.

With respect to major mineral development plans, during 1980 construction was under way at the Cerro Matoso nickel mining project, and a final agreement for the El Cerrejón coal deposit was concluded and construction of infrastructure at the mining site began. Through the Empresa Colombiana de Petróleos (ECOPETROL), Colombia continued its intense efforts to increase crude oil and natural gas production and reserves. Additional association contracts with foreign oil companies were signed, and exploration results have been promising. In 1980, domestic crude oil production was estimated to have provided for about 83% of national demand.

Mining as a whole represented only 1% of the GNP, but the Plan of National Integration (PIN) set the development of energy and mining among the major national goals. PIN advocated a program of public investment in selected high-priority sectors and the provision of direct incentives to encourage private and foreign investment in these areas. A portion of the public investment visualized by PIN was to come from foreign loans. National budget investments in mining and energy increased by 240% between 1978 and 1980, and foreign investment in mining (not including petroleum) increased from $53.7 million in the 1975-77 period to almost $1.4 billion in the 1978-80 period.

The demand for electric energy has been increasing at a rate of over 10% per year. Colombia's Caribbean region, where power is generated by thermal units, was unaffected by the electricity shortages caused by exceptionally light rainfall in the rest of the country which is dependent on hydroelectric generation. During 1980, only residential consumers in the interior were subjected to electricity cutoffs, but industrial users were asked to voluntarily restrict consumption by 10%. Government officials have suggested that the 1980 restrictions may not be sufficient for 1981. By mid-1982, a transmission line linking the national

power network to the Caribbean coast, plus a 15% increase in electric power generation, will help reduce power shortages. Power projects involving over 2,200 megawatts are under construction, with completion planned by 1988.

In December 1979, Nicaragua extended its maritime limit to 200 miles and rejected the 1928 and 1972 agreements which assigned to Colombia ownership of some islands lying within the new maritime jurisidiction. Nicaragua claimed ownership of the Colombian islands of San Andrés and Providencia, and the cays of Roncador, Quita Sueño, and Serrana. The decree establishing the maritime limit specifically mentioned Nicaraguan ownership of natural resources within the zone. Nicaragua indicated it would pursue its claim by legal means. In October 1980, Nicaragua published a new map which showed the disputed islands and cays as part of Nicaraguan territory.

Another jurisdictional dispute has peripheral mineral resource implications. The question of the exact maritime boundary between Colombia and Venezuela has been under negotiation for over a decade. In October 1980, a draft agreement was published by the two countries, but it evoked internal opposition on both sides and formal signing was delayed. The main issues have been Venezuela's claim that the Gulf of Venezuela is an "internal sea" over which it should have absolute sovereignty, and Colombia's insistence that the Los Monjes Islands are the territory of Colombia. In the proposed agreement, Colombia cedes its right to the Los Monjes, and Venezuela recognizes limited Colombian rights in the Gulf. Among other things, the draft deals with the issue of sharing and/or ownership of hydrocarbons. Although there has been no drilling in the Gulf, it is believed that the area contains considerable potential for crude oil and natural gas.

Colombia has several mineral projects in various stages of exploration (copper, molybdenum, uranium, bauxite), feasibility study (phosphate), or development (coal, nickel), which by the mid-1980's should visibly impact on the mining sector's contribution to the economy.

PRODUCTION

Colombia's production of mineral commodities was estimated to have remained fairly stable in 1980, as shown in table 1.

In 1980, precious-metal production increased significantly and was estimated to have ended the year with volumes of gold, in particular, showing a significant 87% gain over the 1979 production level. Gains in silver (52%) and platinum (11%) were more modest. In 1980, production began from Colombia's first asbestos mine.

After a marked decline in 1979, steel production in 1980 was estimated to have increased 12%, surpassing the level produced in 1978. Of the mineral fuels, coal and natural gas were estimated to have shown some increases over 1979 production. The production of crude oil was also slightly higher than in 1979, an encouraging factor in that the steady decline experienced during the last decade may be leveling off.

Table 1.—Colombia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Chromite, gross weight	(3)	(3)	(3)	(3)	--
Copper, mine output, metal content	r65	r78	100	84	4111
Gold ---troy ounces	300,307	263,437	257,632	265,609	4497,028
Iron and steel:					
Iron ore and concentrate ---thousand tons	r542	r505	497	397	4506
Pig iron ---do	286	223	298	241	4279
Ferroalloys: Ferrosilicon[e]	1,200	1,200	1,200	1,200	1,200
Crude steel ---thousand tons	356	330	391	362	4405
Semimanufactures, hot-rolled ---do	300	294	332	307	4320
Lead, mine output, metal content	r208	r166	120	226	4187

See footnotes at end of table.

Table 1.—Colombia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Manganese ore, gross weight	7,798	11,875	20,011	21,453	[4]21,400
Platinum-group metals ____ troy ounces	16,779	[r]17,315	14,911	12,933	[4]14,345
Silver ____ do	106,812	91,420	83,398	99,256	[4]150,489
Zinc, mine output, metal content	[3]	--	--	--	--
NONMETALS					
Asbestos	[e]5,000	--	NA	NA	NA
Barite	[r]3,100	[r]3,450	3,500	3,500	3,500
Cement, hydraulic ____ thousand tons	[r]3,612	3,298	4,153	4,257	[4]4,351
Clays:					
Bentonite	[3]	[3]	[3]	[3]	--
Kaolin	[r]860,000	[r]790,000	783,000	819,150	1,014,000
Diatomite	650	630	630	630	630
Feldspar	[r]30,000	26,508	26,455	29,200	[4]27,150
Gypsum ____ thousand tons	205	210	255	257	[4]247
Lime, hydrated and quicklime[e] ____ do	1,000	1,300	1,300	1,300	1,300
Magnesite	[r]1,632	1,770	1,400	1,582	[4]1,582
Mica	[3]	[3]	--	--	--
Nitrogen: N content of ammonia	90,400	65,100	63,600	90,000	90,000
Phosphate rock	[r]9,300	5,800	1,320	6,776	[4]8,370
Precious and semiprecious stones: Emerald:					
Gem stones ____ carats	NA	60,575	NA	NA	NA
Moralla ____ do	NA	[5]423,937	NA	NA	NA
Total[6] ____ do	499,802	484,512	894,888	1,228,488	[4]275,111
Salt:					
Rock ____ thousand tons	186	181	178	176	[4]169
Other ____ do	925	741	573	458	[4]718
Total ____ do	1,111	922	751	634	[4]887
Sodium compounds: Sodium carbonate	149,374	140,588	167,172	133,217	[4]124,629
Stone and sand:					
Calcite	7,800	8,280	8,500	8,500	8,500
Dolomite ____ thousand tons	23	22	32	29	[4]14
Limestone ____ do	7,800	8,112	9,431	9,700	[4]9,118
Marble	10,832	8,688	12,039	16,891	[4]117,000
Sand, excluding metal-bearing	[r]398,342	[r]428,854	440,000	480,000	[4]385,000
Sulfur:					
Native (from ore)	[r]17,800	[r]27,000	35,000	16,050	[4]25,647
Byproduct, from petroleum	[e]2,000	[e]2,000	3,239	2,262	[4]1,959
Total	[r]19,800	[r]29,000	38,239	18,312	[4]27,606
Talc, soapstone, pyrophyllite	[r]2,200	3,380	4,320	6,085	6,085
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	[e]26,300	4,200	NA	NA	NA
Coal, all grades ____ thousand tons	4,000	4,204	4,754	4,885	[4]5,260
Coke, all types ____ do	[r]420	500	530	507	500
Gas, natural:					
Gross ____ million cubic feet	117,924	122,325	147,014	150,695	[4]160,666
Marketed ____ do	66,715	74,217	97,319	108,181	[4]118,534
Natural gas liquids:					
Propane ____ thousand 42-gallon barrels	3,041	[e]2,645	2,614	2,491	[4]2,712
Butane ____ do	666	582	589	552	[4]577
Natural gasoline ____ do	696	700	723	816	[4]790
Condensate ____ do	[3]	[3]	[3]	--	--
Total ____ do	4,403	3,927	3,926	3,859	[4]4,079
Petroleum:					
Crude ____ do	53,376	50,222	47,742	45,298	[4]45,944
Refinery products:					
Gasoline:					
Aviation ____ do	360	373	374	443	[4]428
Motor[7] ____ do	21,357	23,236	18,348	18,042	[4]20,400
Jet fuel ____ do	2,729	2,895	3,150	3,517	[4]3,521
Kerosine ____ do	3,302	3,156	3,069	3,209	[4]2,730
Distillate fuel oil ____ do	7,583	7,505	7,961	7,768	[4]8,584
Residual fuel oil ____ do	18,321	18,420	18,947	15,254	[4]17,023

See footnotes at end of table.

Table 1.—Colombia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Lubricants thousand 42-gallon barrels	339	351	333	511	[4]403
Other:					
Liquefied petroleum gas do	2,100	1,992	1,819	1,729	[4]1,975
Asphalt and bitumen do	566	458	598	706	[4]942
Refinery fuel and losses and unspecified products do	2,427	1,978	2,853	8,067	[4]7,239
Total do	59,084	60,364	57,452	59,246	[4]63,245

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Oct. 21, 1981.

[2]In addition to the commodities listed, coal briquets are also produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3]Revised to zero.

[4]Reported figure.

[5]U.S. imports, largely moralla and gangue, but also including some gem-quality emerald.

[6]Data represent total Colombian exports.

[7]Includes "industrial benzine" (white gasoline).

TRADE

Minerals and mineral-related commodities continued to occupy a minor position in Colombia's overall international trade. Mineral exports were not expected to show a significant growth until the Cerro Matoso nickel project comes onstream in 1982 and the El Cerrejón coal project starts up about 1986.

Excluding coffee, which accounted for about 57% of the $3.4 billion value of 1979 exports, mineral-related exports and petroleum products each contributed about 10% to the value of exports.

In 1979, crude oil and refined product imports were valued at $571 million, representing a 135% increase over the 1978 cost. The volume of imported crude oil in 1979 was approximately 9 million barrels, a 2% increase over that of 1978. Refined petroleum product volumes increased to 10.3 million barrels, a 33% increase over that of 1978. Petroleum imports represented 12% of total registered import costs in 1979. In 1980, about 7.3 million barrels of crude oil were imported at a cost of $220 million, while 13 million barrels of refined products were imported at a cost of $491 million.

For 1980, it was estimated that all petroleum purchases represented about 13% of the estimated $5.4 billion total import cost and that fuel oil sales represented 17% of registered exports of goods other than coffee.

Table 2.—Colombia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Destinations, 1977	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	364	339	--	Ecuador 325; Venezuela 5; Chile 3.
Chromium ore and concentrate	3,807	2,265	2,185	Chile 80.
Copper:				
Ore and concentrate	1,780	2,953	500	Japan 2,453.
Metal including alloys, unwrought and semimanufactures	9	12	(1)	Ecuador 7; Venezuela 3; Costa Rica 1.
Gold:				
Ore and concentrate	418	376	11	Sweden 165; Belgium-Luxembourg 160; Benin 40.
Metal including alloys, unworked or partly worked, troy ounces	6,559	--		
Iron and steel metal:				
Pig iron, ferroalloys, similar materials	8,802	7,783	--	Venezuela 7,677; Ecuador 105.
Steel, primary forms	55	15	--	All to Honduras.
Semimanufactures:				
Bars, rods, angles, shapes, sections	1,280	364	--	Venezuela 290; Ecuador 33; Costa Rica 23.
Universals, plates, sheets	510	201	1	Panama 123; United Kingdom 25.
Hoop and strip	6	20	--	Ecuador 18; Cuba 1.
Rails and accessories	1,300	2	--	All to Ecuador.
Wire	513	153	--	Ecuador 50; Peru 31; Bolivia 23.
Tubes, pipes, fittings	1,735	1,930	--	Venezuela 1,307; Ecuador 174; Cuba 155.
Castings and forgings, rough	148	457	80	Peru 217; Costa Rica 60; Venezuela 51.
Lead:				
Ore and concentrate	234	346	346	
Metal including alloys, all forms	9	9	--	Mainly to Venezuela.
Manganese ore and concentrate	--	520	--	All to Ecuador.
Nickel metal including alloys, all forms, kilograms	1,000	3	--	All to Panama.
Platinum-group metals including alloys, unwrought, troy ounces	r13,760	7,523	7,523	
Tin metal including alloys, all forms, kilograms	--	1	--	All to Panama.
Zinc metal including alloys, all forms, do.	330	500	--	Do.
Other:				
Ores and concentrates	160	110	110	
Ash and residue containing nonferrous metals	116	--		
Base metals including alloys, all forms	1	4	--	Italy 3; Venezuela 1.
NONMETALS				
Abrasives, natural including industrial diamond, kilograms	287	12,457	300	Ecuador 6,498; Venezuela 5,606.
Cement	677,370	432,605	4,001	Ecuador 171,634; Venezuela 91,341; Netherlands Antilles 46,830.
Chalk	--	3,190	200	Venezuela 1,500; Dominican Republic 1,210; Ecuador 140.
Clay products:				
Refractory including nonclay brick	505	1,992	--	Ecuador 1,162; Venezuela 644; Costa Rica 85.
Nonrefractory	23,219	30,598	2,549	Venezuela 23,853; Peru 2,152; Dominican Republic 777.
Fertilizer materials:				
Manufactured:				
Nitrogenous	r18,701	1,307	--	Venezuela 1,300; Panama 7.
Other including mixed	r9,188	13,904	--	Venezuela 5,000; Martinique 3,902; El Salvador 3,000.
Ammonia	5,421	8,790	5,022	Costa Rica 3,499; Ecuador 269.
Gypsum and plasters	--	1,695	--	Venezuela 1,615; Ecuador 80.
Precious and semiprecious stones, kilograms	3	171	129	Japan 35; Ecuador 3.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	4,615	--		
Sodium sulfate	--	382	--	Ecuador 245; Peru 110; Argentina 25.
Soda ash	14,120	5,329	--	Argentina 2,696; Ecuador 1,400; Peru 686.
Stone, sand and gravel	247	80	(1)	Ecuador 40; Venezuela 22; Bolivia 10.
Other:				
Crude	1,557	596	--	Ecuador 396; Venezuela 107; Panama 40.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	--	15,297	40	Ecuador 6,587; Venezuela 6,333; Suriname 1,016.

See footnotes at end of table.

Table 2.—Colombia: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Destinations, 1977	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	10,160	8,952	--	Chile 4,052; Guatemala 1,528; Ecuador 1,318.
Coal:				
Anthracite	15,666	17,223	15	Costa Rica 11,429; France 5,723.
Bituminous	3,085	101,489	(1)	Argentina 77,641; Mexico 21,700; Venezuela 2,000.
Coke and semicoke	33,896	46,130	20	Venezuela 38,647; Chile 3,387; Ecuador 2,314.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	53	60	30	Mexico 30.
Residual fuel oil do	r7,149	7,478	5,585	Bahamas 950; Canada 466; Mexico 255.
Mineral jelly and wax do	25	31	20	United Kingdom 3; West Germany 3; France 2.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r10,010	1,344	--	Argentina 1,034; Venezuela 284.

r Revised.
1 Less than 1/2 unit.

Table 3.—Colombia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	16,032	15,745	1,416	Venezuela 5,129; Canada 4,635; Yugoslavia 2,101.
Copper metal including alloys, all forms	5,863	8,167	109	Chile 4,297; Peru 1,474; Mexico 1,312.
Iron and steel:				
Ore and concentrate	397	49	--	All from West Germany.
Metal:				
Scrap	8,815	11,996	646	Netherlands Antilles 9,849; Trinidad and Tobago 1,216.
Pig iron and similiar materials	692	1,223	280	Brazil 882; Japan 24; Norway 14.
Ferroalloys:				
Ferromanganese	6,208	2,524	56	Brazil 1,215; Chile 977; Taiwan 150.
Ferrosilicon	1,143	1,157	17	Venezuela 1,065; Chile 75.
Steel, primary forms	13,153	29,700	68	Japan 19,509; Chile 8,476; United Kingdom 800.
Semimanufactures:				
Bars, rods, angles, shapes, sections	21,731	25,253	914	Japan 13,407; Spain 4,238; Brazil 2,238.
Universals, plates, sheets	162,096	199,255	6,685	Japan 184,368; France 2,175; United Kingdom 2,158.
Hoop and strip	r4,517	5,696	1,577	United Kingdom 1,747; Japan 1,497; West Germany 536.
Rails and accessories	625	364	45	United Kingdom 304; West Germany 14.
Wire	4,064	4,648	104	Brazil 2,017; Japan 961; Venezuela 782.
Tubes, pipes, fittings	53,511	9,042	1,398	Japan 4,890; Brazil 874; Argentina 447.
Castings and forgings, rough	67	346	103	Belgium-Luxembourg 166; Spain 44; United Kingdom 29.
Total	r246,611	244,604		
Lead:				
Oxides	1,029	--		
Metal including alloys, all forms	2,958	505	7	Peru 338; Mexico 82; Denmark 60.
Manganese:				
Ore and concentrate	4,446	7,037	3,000	Ghana 2,919; Mexico 1,118.
Oxides	744	692	467	Belgium-Luxembourg 120; Ireland 100.

See footnotes at end of table.

Table 3.—Colombia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS —Continued				
Nickel metal including alloys, all forms	228	232	70	Canada 94; West Germany 26; France 14.
Silver:[1]				
Ore and concentrate—kilograms	18	10	10	
Metal including alloys, all forms thousand troy ounces	27	10,629	172	Peru 10,448.
Tin metal including alloys, all forms	324	389	1	Bolivia 325; United Kingdom 29; Malaysia 21.
Titanium oxides	473	657	233	West Germany 219; United Kingdom 84; Italy 51.
Zinc metal including alloys, all forms	11,981	11,105	15	Peru 5,948; Mexico 4,347; Canada 640.
Other:				
Ores and concentrates	3,002	1,373	97	Guyana 1,105; United Kingdom 61; Australia 60.
Base metals including alloys, all forms	757	1,185	405	Mexico 502; Canada 219; Ecuador 27.
NONMETALS				
Abrasives, natural including industrial diamond	860	885	372	Mexico 426; Netherlands 77.
Asbestos	19,954	19,341	1,849	Canada 14,727; Republic of South Africa 2,256.
Cement	--	19	--	All from Spain.
Clay and clay products:				
Crude clay: Kaolin	3,208	5,550	5,414	United Kingdom 101.
Products:				
Refractory including nonclay brick	6,419	6,647	4,170	Canada 926; Austria 859.
Nonrefractory	1,282	2,746	1,597	Italy 739; Spain 176.
Fertilizer materials:				
Crude:				
Phosphatic	9,219	37,792	37,792	
Other	100	200	(2)	Poland 200.
Manufactured:				
Nitrogenous	23,093	145,214	49,905	Republic of Korea 24,547; Republic of South Africa 21,900; Venezuela 19,790.
Phosphatic	--	19,693	14,606	Mexico 5,000
Potassic	16,700	108,070	44,661	East Germany 30,414; Spain 27,990; West Germany 5,005.
Other including mixed	5,559	6,307	5,779	Norway 316; Israel 104; Belgium-Luxembourg 100.
Ammonia	23,035	29,704	5,250	Venezuela 19,919; Trinidad and Tobago 5,250.
Pigments, mineral: Iron oxides, processed	727	907	33	West Germany 765; Spain 35; Mexico 27.
Precious and semiprecious stones including gem diamond[3] kilograms	65	6,338	--	Czechoslovakia 4,418; Yugoslavia 1,034; Brazil 749.
Pyrite, unroasted, gross weight	48	69	69	
Sodium and potassium compounds, n.e.s.:				
Caustic soda	1,640	15,106	3,876	Romania 4,350; Peru 3,979; Italy 2,646.
Soda ash	--	4,012	4,000	United Kingdom 10.
Stone, sand and gravel:				
Dolomite, chiefly refractory grade	4,917	6,070	1,410	Uruguay 2,285; Belgium-Luxembourg 1,800.
Other	21,347	8,263	127	Dominican Republic 7,200; Peru 292; Belgium-Luxembourg 219.
Sulfur, elemental other than colloidal	24,750	23,033	--	Venezuela 12,097; Netherlands Antilles 10,936.
Talc and steatite	--	1,394	1,253	Italy 94; Brazil 32; United Kingdom 11.
Other:				
Crude	4,611	3,756	1,062	Peru 810; Mexico 532; Morocco 316.
Oxides and hydroxides of magnesium, strontium, barium	--	460	320	France 66; Italy 21; China, mainland 20.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	681	909	483	Canada 295; West Germany 97; Japan 17; France 17.
Coal including coke and briquets	65	143	143	
Gas, hydrocarbon, natural and manufactured kilograms	7,112	12,885	42	France 5,692; Spain 5,457; Japan 1,676.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	r2,551	6,455	--	Venezuela 5,306; Ecuador 1,149.

See footnotes at end of table.

Table 3.—Colombia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products —Continued				
Refinery products:				
Gasoline, aviation thousand 42-gallon barrels	r162	2,761	--	Netherlands Antilles 2,077; Brazil 569; Mexico 115.
Kerosine ---------- do	--	87	(2)	Netherlands Antilles 87.
Lubricants ---------- do	r10	10	9	Netherlands Antilles 1.
Mineral jelly and wax -- do	28	6	3	West Germany 2.
Other ---------- do	r84	82	37	Netherlands Antilles 29; Trinidad and Tobago 7; Venezuela 6.
Total ---------- do	r284	2,946		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	608	669	450	West Germany 141; United Kingdom 59.

r Revised.
[1] May include platinum and platinum-group metals.
[2] Less than 1/2 unit.
[3] May include pearls.

COMMODITY REVIEW

METALS

Bauxite.—Exploration work continued on the Morales-Cajibío bauxite deposits located in Cauca Department and the San Antonio deposits in Valle de Cauca Department. Reserves are estimated to be about 375 million tons grading 40% Al_2O_3. If warranted by exploration results and ongoing density and chemical studies being conducted in the United States and Belgium, a $1.8 million feasibility study may be conducted. The possibility of a 240,000-ton-per-year aluminum plant estimated to cost $1 billion has been proposed.

Copper.—The Government continued its studies on several copper deposits. Exploration of the Alisales deposit in Nariño Department continued, and consideration was being given to a possible joint development project with Texas Petroleum Co., which originally discovered the prospect in 1968. Ore reserves at Alisales were estimated at 400,000 tons, averaging 3% to 10% copper, along with some molybdenum.

The Mocoa copper-molybdenum deposits in the Department of Putumayo near the Ecuadorian border were under development study by the Institute of Geological and Mineral Investigations (INGEOMINAS) in a joint venture with the United Nations Development Program. INGEOMINAS has reportedly invested $2 million in this study, which is expected to be completed in mid-1981. Ore reserves were estimated at about 100 million tons, although earlier reports indicated a considerably higher tonnage.

Colombia has so far committed almost $2 million toward the exploration of the Los Pantanos-Pegadorcito copper-molybdenum deposits in the Department of Antioquia. Potential ore reserves are estimated at 420 million tons. Tentative estimates indicate that with an investment of $1 billion, production could amount to 120,000 tons of copper per year for a period of 20 years.

Gold.—According to preliminary estimates, gold production in 1980 rose 87% above the 1979 level. Colombia now ranks second only to Brazil in Latin American gold production. Over 80% of production comes from one mine and many alluvial operations in Antioquia Department.

In November 1980, direct administration of the gold mines in Marmato (Department of Caldas), located about 300 kilometers northeast of Bogotá, was assigned to State-owned Empresa Colombiana de Minas (ECOMINAS) and the mines were declared a natural resource. The area is divided into

two zones. In the uppermost, Zone A, approximately $120,000 was invested during 1980, with an additional $200,000 investment planned for 1981. By the end of 1980, Zone A had been determined to contain about 6 million tons of ore averaging 0.225 ounce to 0.322 ounce of gold per ton. Reserves are thought to be sufficient to justify the construction of a $5 million plant which could process 250 tons of ore per day. Zone B, the lowermost zone, contains estimated potential reserves of 3 million tons, which average the same gold content as Zone A. The development of Zone B would probably require an additional $5 million investment.

Iron Ore.—In May 1980, after over 20 years of contested ownership, a presidential decree assigned ownership of the Belencito iron ore deposits exploited by Acerías Paz del Río, S.A. (APR), in Boyacá Department to ECOMINAS. The decree also decided ownership of the coal deposits mined by APR to the State-owned company Carbones de Colombia (CARBOCOL). Since its founding in the early 1950's, APR's ownership has changed from less than 1% private to over 96% private. The Government maintained that this shift in company ownership, from majority Government-owned to majority privately owned, also did not change the legal position of the mineral resources used by the company from that of publicly owned resources.

The decree reaffirmed State ownership of the minerals, but did not affect a company's right to exploit them by means of permits, licenses, or concession contracts. APR was given preferential rights to mine the deposits. Royalty payments were to be made to the Instituto de Desarrollo del Departamento de Boyacá (IDEBOY), the Boyacá departmental development agency. APR estimated these iron ore reserves in Boyacá Department to be 73 million tons.

In Córdoba Department, a study was under way on the iron deposits at Cerro Matoso where the nickel and iron ores overlay one another. Metallurgical and concentration tests were being conducted in Colombia, the United States, and Belgium to determine whether a feasibility study is warranted. Present estimates of iron ore reserves at Cerro Matoso are about 15.7 million tons averaging 46% iron. It was reported that any feasibility study undertaken would include the possible installation of a sponge iron reduction plant to take advantage of natural gas to be transported to the area.

Nickel.—If construction does not fall behind schedule, Cerro Matoso, S.A., planned to initiate its first ferronickel shipments to Billiton Metals and Ores International Ltd. by mid-1982 from the plant at Montelibano to the Port of Cartegena.

Energy needs are to be supplied from the San Carlos hydroelectric project in Antioquia Department, from the Carbones de Caribe's new coal mine located 30 miles from the mine, and from natural gas piped from the Jobo Tablón Fields in the Guajira Peninsula. The vital importance of cheap domestic energy can be demonstrated by the financial problems Falconbridge Dominicana S.A. has endured in the Dominican Republic where the ferronickel company is entirely dependent on imported oil and was forced to close down for an extended period in 1980 because of the combined effects of high operating costs and depressed world markets.

When operating at the planned full plant capacity of about 60,000 tons of ferronickel, yielding 50 million pounds of nickel per year, Cerro Matoso would account for approximately 35% of present Latin American nickel capacity, excluding Cuba, and perhaps 3% of total world output. Colombia's ferronickel production in 1982 was projected at about 20,000 tons. Full production may be attainable in 1985.

The 25-year mining concession granted by the Government provided for an 8% royalty payable in kind which, at nickel prices averaging $3.00 per pound on the free market, could yield the Government $12 million in revenue, as well as add $150 million to Colombia's foreign exchange earnings.

NONMETALS

Asbestos.—In 1980, Minera Las Brisas, S.A., opened Colombia's first asbestos mine in Antioquia Department. Full capacity of the mine was planned to be 20,000 tons per year of No. 4 and No. 6 fiber. The reserves have been estimated as sufficient to yield almost 390,000 tons of asbestos fiber over the life of mine.

Cement.—Colombia's 1980 installed portland cement production capacity from 16 plants was 5.5 million tons. New construction in the central region and other expansion projects are expected to increase total capacity to 6.3 million tons by yearend 1981 and to 6.8 million tons by 1983. Domestic demand has been about 3 million tons per

year which allows a substantial amount for export markets.

Regional cement shortages have occurred, particularly in the central area near Bogotá. Two new cement plants are planned for the central region. One, located at Paz del Río, will utilize blast furnace slag from the nearby steel complex, and is scheduled to come onstream by yearend 1981. This plant will further diversify from Colombia's primarily gray portland cement production because the slag cement is suited for use in heavy construction work, such as dams and highways. Output from four asbestos cement plants at Bogotá, Cali, and Barranquilla are primarily exported.

Emeralds.—Royalty payments from emerald mining continued to provide ECOMINAS with assured cash income for use in other mineral development projects. The main mines located at Muzo, Cozcuez, and Peñas Blancas in Boyacá Department accounted for the major share of official production.

By preliminary estimates, 1980 legal emerald exports were valued at $64.6 million. Japan, the United States, and Taiwan accounted for about 92% of these exports. By some estimates, the legal export of emeralds actually represents only 40% of the real amount exported, the remainder is smuggled out of the country illegally.

It was reported that the private companies, which pay fixed amounts plus royalty to the Government for their mining concessions, consider these amounts too high in relation to actual production, and they have suggested a renegotiation of terms.

Fertilizer Materials.—*Phosphate Rock.*—The preliminary feasibility study initiated by ECOMINAS in late 1979 on the Pesca (Boyacá Department) and Sardinata (Notre de Santander Department) phosphate rock reserves was broadened in 1980 and scheduled for completion in late 1982. At an additional estimated cost of $3.8 million, the expanded study will include reserve evaluations, as well as suitable mining, processing, and marketing alternatives. The total cost of the study is now estimated at $6.9 million. Tentative estimates assign Pesca reserves of over 29 million tons containing 20% P_2O_5, while Sardinata may have about 9 million tons of reserves containing 31% P_2O_5. If the preliminary study is favorable, further studies could also involve the feasibility of constructing downstream processing plants.

MINERAL FUELS

Colombia derives 54% of its total energy needs from petroleum, 22% from coal, less than 17% from natural gas, and less than 8% from hydroelectricity. There have been some regional energy shortages because of droughts experienced in areas dependent upon hydroelectric power sources. Especially affected have been the industrialized cities of the interior region. New thermal electric plants in the Caribbean coastal area are being adapted for the use of both natural gas and coal as fuel sources. By 1982, Colombia plans to complete transmission lines linking the coastal area and the industrial area of the interior. If construction schedules are maintained, power projects, mostly hydroelectric, will add over 2,200 megawatts to capacity by 1988. Planning has been based on a 80-20 ratio of hydropower to thermal electric plants.

Coal.—The disputed ownership of the coal deposits mined by APR in Boyacá Department was settled in May 1980 when a presidential decree assigned limited ownership to CARBOCOL. The disposition did not restrict mining by private companies, with APR receiving priority mining contract rights, but it did reassert that the coal is a national resource with undisputed State ownership. APR has estimated the volume of coal involved in the dispute amounts to about 58 million tons. APR will pay a royalty to IDEBOY, the Boyacá Departmental Development Agency.

In September 1980, International Colombia Resources Corp. (INTERCOR), an Exxon Corp. subsidiary, and CARBOCOL, signed a contract to proceed with the development of the northern zone (Block B) of the El Cerrejón coal deposits located in the south-central area of the Guajira Peninsula. The north block development area contains an estimated 1.6 billion tons of coal reserves of the total 3.5 billion tons in the El Cerrejón area.

Originally projected to cost $1 billion, this amount has now escalated to $3 billion. Development includes two opencast mines with excavation down to 200 meters, a new port and other infrastructure at Bahía de Portete on the Caribbean Sea, a 150-kilometer railroad linking the mining area and the port, and a complete town with necessary social infrastructure. The construction phase of the project could employ 8,000 workers, with the operating phase decreasing direct employment to 4,000 or

5,000. However, with auxiliary employment opportunities, the project could provide as many as 15,000 jobs.

The joint agreement extends for 23 years, starting with the first production from the mine, expected to occur in 1986. INTERCOR agreed to pay CARBOCOL a royalty of 15% of its 50% share of production at the mine-head, either in cash or kind. The percent royalty paid is scheduled to increase as production exceeds projected levels. After taxes, royalty, and other payments, INTERCOR's net share of profits are expected to be about 17%. All production has been targeted for export to Europe and the Far East.

Production at El Cerrejón is expected to reach 15 million tons per year during its first phase, but if demand warrants, this could be expanded to 25 million tons per year by 1990. In any case, only about one-fourth of the total Block B reserves are expected to be extracted by the expiration date of the contract.

Available analyses show that the El Cerrejón deposit is a low-sulfur steam coal averaging about 0.5% sulfur content, 4% ash content, 38% to 42% volatile matter, 54% to 56% fixed carbon, and has a calorific value of 13,500 Btu's per pound.

CARBOCOL reportedly has begun preparations to mine the 10,000-hectare Central Block of the El Cerrejón deposits. A partner has not yet been selected for this project, but mining is expected to commence in 1982 at a rate of about 300,000 tons per year, increasing to 1.5 million tons per year by 1984. The major part of output is scheduled to be used by a new steam generating plant to be constructed at the mouth of the Cañas River on the Guajira coast. The remainder of production may be used by various cement and other industrial users.

At Puerto Libertada in Córdoba Department, a Cementos del Caribe subsidiary, Carbones del Caribe S.A., was developing a steam prospect for use at the Cerro Matoso ferronickel project and coastal cement plants. Other coal development projects were under way near La Loma and La Jagua in central César Department, located to the south of La Guajira Department.

Brazil, Romania, Spain, and Colombia have been conducting studies on the development of metallurgical coal in three areas near Bogotá in Cundinamarca Department.

There are some small-scale gasification projects in Medellín undertaken by local industries, but given the abundance of available natural gas, serious large-scale projects do not enter into Government's near- or medium-term planning. Coal liquefaction is also not comtemplated for this century unless crude oil production falls short of expectations and import costs and supply factors present a compelling need.

Present and projected uses of coal by type have been estimated in the PIN national development plan and are shown in the following table, in million metric tons:

Type and use	1979	1980	1981	1985	1990
Thermal coal:					
Power generation	.7	.8	1.0	4.0	6.5
Cement production	.6	.6	.8	1.2	1.5
Other users	2.6	2.8	3.3	4.3	5.3
Export potential	--	--	--	1.0	16.1
Total	3.9	4.2	5.1	10.5	29.4
Metallurgical coal:					
Steel industry	.9	.9	.9	1.2	1.9
Exports	.3	.4	.5	.5	1.0
Total metallurgical	1.2	1.3	1.4	1.7	2.9
Total demand	5.1	5.5	6.5	12.2	32.3

Natural Gas.—There were several encouraging gas discoveries during 1980. In January, Mobile Oil Co. made a discovery at Las Estrellas off the Guajira Peninsula which apparently indicated a small but significant field. In February, International Petroleum announced that a test in Sucre Department indicated the presence of about 10 million barrels of oil and had a producing potential of as much as 60 million cubic feet of natural gas per day. Further testing was planned.

Also in the Guajira area, south of Ríohacha, Texas Petroleum Co. and its joint partner ECOPETROL revealed a gas strike which tested gas at two intervals, both greater than 8,000 feet in depth.

Colombia has known gas reserves of about 4.7 trillion cubic feet, of which about 76% are located at onshore and offshore locations of the Guajira Peninsula, mostly in the Chuchupa, Ríohacha, and Ballenas Fields. The Middle Magdalena Valley contains another 15% of natural gas reserves, and the remainder is in the Putumayo and the Upper and Lower Magdalena Basins.

The productive capacity of the Guajira

Fields is about 200 million cubic feet per day, but production had traditionally been about one-half of that amount due to limited demand and transportation facilities. The completion of a pipeline linking the offshore Chuchupa Field and the main line to Cartagena was mainly responsible for the increased production in 1980. It has been estimated that capacity could be doubled to 400 million cubic feet per day from the Guajira Peninsula.

Even though a 1979 study was not entirely favorable, a liquefied natural gas project in cooperation with El Paso Natural Gas Co. remained under consideration to utilize the Guajiro natural gas for export to the United States. A petrochemical complex is also under consideration which would utilize about 60 million cubic feet per day of Guajiro natural gas to produce 430,000 tons per year of urea.

Colombia's current and projected uses for recovered natural gas, in millions of cubic feet per day, is shown below:

Use	1980	1981	1982
Power generation	149	160	161
Cement production	28	29	30
Other industrial	130	138	161
Other users	1	2	2
Total	308	329	354

Petroleum.—Production of crude petroleum in 1979 averaged about 124,100 barrels per day, compared with the 1978 average of about 130,800 barrels per day. Petroleum production rose slightly in 1980 to an estimated 125,600 barrels per day. In 1979, output came from 30 fields and the largest of these, Mares, averaged 24,900 barrels per day, a slight increase over 1978 production. In the Orito Field, 1979 production averaged 19,800 barrels per day, a 13% decline from that of 1978. In 1980, production from this field averaged 17,400 barrels per day. In 1979, petroleum was produced by ECOPETROL directly (20%), by concessionaires (67%), and through ECOPETROL association contracts (13%).

Table 4.—Colombia: Crude oil production, by company

(Thousand 42-gallon barrels)

Company	1977	1978	1979	1980	Change percent
Petrolera del Río Panamá S.A.[1]	10,693	9,227	8,046	7,403	-8
ECOPETROL	9,095	8,980	9,085	9,456	4
International Petroleum (INTERCOL)[2]	5,399	4,745	4,183	3,638	-13
Texas Petroleum Co. (Texpet)	5,337	5,033	4,887	4,770	-2
Shell-Explotaciones Cóndor S.A.	5,129	4,941	5,162	5,617	9
Houston Oil Colombiana S.A.[3]	4,273	4,864	4,807	6,237	30
Chevron Petroleum Co. of Colombia	3,701	2,984	2,235	1,683	-25
Colombian Petroleum Co.	3,699	3,397	3,417	3,293	-4
ECOPETROL-Colombia Cities Service Petroleum Corp. (COLCITCO)[4]	1,645	2,377	2,251	2,134	-5
ECOPETROL-Terra Resources	694	629	474	422	-11
Antex Oil and Gas Co. Inc.[5]	373	337	319	315	-1
ECOPETROL-Aquitaine Colombia S.A.	184	--	--	--	--
ECOPETROL-Chevron	--	228	432	976	126
Total	50,222	47,742	45,298	45,944	1

[1]Operated the Orito Field-Putumayo, owned 50% by Texaco and 50% by Petrolera del Río Panamá S.A. (Petrorio). Petrorio in turn is owned 50% by ECOPETROL and 50% by Cayman International Corp. Texaco sold its share in late 1979.

[2]Exxon Corp. affiliate.

[3]Purchased in early 1980 from Petróleos Colombo Brasileros S.A. Houston Oil Colombiana S.A. is a subsidiary of Houston Oil International, Inc., which is owned by Tenneco, Inc.

[4]Cities Service, ECOPETROL, Amoco, and ARCO each own 25%.

[5]Condensate.

In May 1980, the Government changed its pricing policy on "old" oil from developed sources and agreed to increase the amount it was paying oil companies for the oil. It was anticipated that this action would result in a greater production from some concession fields.

Domestic consumption of petroleum products and natural gas equivalents rose 4% in 1979 and averaged 182,000 barrels per day. In 1980, consumption increased 2.8% and averaged 187,000 barrels per day. In both years over 38% of domestic use was in the form of motor gasoline. Between December 1978 and October 1980, the Government has increased gasoline prices by 175% and transportation fares by 130%. ECOPETROL continued to subsidize the retail sale of motor gasoline and diesel fuel. In October 1980, both regular gasoline and diesel fuel cost about $0.90 per gallon. It was estimated that gasoline would need to be increased to $1.10 per gallon to bring it into line with cost factors.

Table 5.—Colombia: Salient statistics of the petroleum and natural gas industries[1]

(Thousand 42-gallon barrels unless otherwise specified)

	1974	1975	1976	1977	1978	1979	1980
Petroleum:[2]							
Production	60,867	57,259	53,376	50,222	47,742	45,297	45,944
Imports	--	--	6,725	9,399	8,832	8,986	7,339
Refinery products:							
Refinery throughput (production)[3]	60,093	57,685	59,084	60,364	57,452	59,246	63,245
Export: Residual fuel oil[4]	8,702	8,691	8,767	8,621	11,080	8,966	9,469
Imports:							
Gasoline, motor	207	1,761	2,529	3,452	8,025	9,302	7,592
Distillate fuel oil, lubricants, other	29	263	75	300	77	1,038	5,405
Total	236	2,024	2,604	3,752	8,102	10,340	12,997
Consumption:[5]							
Motor gasoline	21,150	21,559	22,928	23,998	27,123	27,195	27,333
Kerosine	3,306	3,330	3,200	3,103	3,084	2,977	2,590
Jet fuel	2,111	2,292	2,598	2,899	3,150	3,440	3,381
Fuel oil	8,681	8,691	8,767	9,058	7,589	6,981	5,791
Diesel oil	7,049	7,391	7,568	7,856	8,084	8,594	9,402
Other	9,342	2,782	3,111	2,893	1,785	2,792	3,993
Total	51,639	46,045	48,172	49,807	50,815	51,979	52,490
Natural gas:							
Gross production ---- million cubic feet	116,634	120,754	117,924	122,325	147,014	150,695	160,666
Consumption[6] ---- do	65,792	65,905	66,715	74,217	97,319	108,181	118,534
Flared ---- do	19,604	24,580	25,679	26,211	26,452	26,113	26,650
Reinjected ---- do	31,238	30,269	25,530	21,897	23,243	16,401	15,482

[1] Figures may vary from those presented elsewhere in this report because of source.
[2] In 1974, exports of 480,200 barrels were recorded.
[3] Total input includes crude runs to stills plus runs of unfinished oils, topped crude, and natural gas liquids blended at refineries.
[4] Except for 1974, does not include bunker sales to international carriers.
[5] Revised data; excludes liquefied petroleum gas and aviation and bunker sales to international carriers.
[6] Includes gas used by oil companies for fuel.

Sources: Ministerio de Minas y Energía. Memoria 1980. Ministerio de Minas y Energia, Boletin de Minas y Energia, v. 3, No. 7, December 1979, and No. 8, August 1981.

It has been estimated that only about 25% of Colombia's sedimentary basins have undergone any exploration, and investor interest has been high. Colombia encourages participation contracts between ECOPETROL and foreign investors. These contracts typically specify that the associated company will bear the exploration risk, while ECOPETROL shares 50% of all development and operating expenses and receives 60% of production (which includes a 20% royalty). In 1980, ECOPETROL signed about 18 association contracts with 9 companies. At the end of 1980, there were 29 companies holding 41 association contracts.

As exploration activity increased, there were some promising discoveries during 1980 in the Magdalena Valley region, in the eastern Llanos region near the Venezuelan border, and in the northern border area near Saravena. The size of new discoveries could not be estimated on the basis of the wildcat successes, and further exploration was underway to better define the fields.

Wells in the Llanos region have penetrated over 20,000 feet, and discoveries have been mostly heavy crudes for which Colombia does not have adequate processing facilities at this time.

ECOPETROL postponed the planned construction of a 40,000-barrel-per-day refinery in the Llanos Orientales region. The company plans, however, to build a pipeline from this area to the Barrancabermeja refinery. An expansion of the Barrancabermeja refinery was completed in mid-1980, and Colombia's total refining capacity was 196,000 barrels per day.

Uranium.—The Italian State oil company Azienda Generale Italiani Petroli S.p.A. (AGIP) has acquired a 40% interest in the French company Minatome S.A., which has been conducting uranium exploration in Colombia under contract with the Instituto de Asuntos Nucleares de Colombia through the State entity Empresa Colombiana de Uranio (COLURANIO). COLURANIO's exploration contracts with MINATOME includes the eastern slope of the Eastern Range between Cundinamarca and Huila Departments. AGIP will do exploratory drilling in Berlin, Department of Caldas. Compagnie Générale des Matières Nucléaires of France and the Empresa National del Uranio S.A. (ENUSA) of Spain are working in areas in Boyacá, Santander, Meta, Guainía, and Vaupés Departments. Working alone, COLURANIO has initiated exploration in Bolívar, Córdoba, and Santander Departments. Positive indications of uranium were reported in the Department of Guainía where ENUSA's feasibility study should be completed in 1986.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Colombian pesos (Col$) to U.S. dollars at the average exchange rate for December 1979 of Col$44.00=US$1.00. In 1980, the Colombian peso fell from Col$44.41=US$1.00 in January to Col$50.60=US$1.00 in December.

The Mineral Industry of Cyprus

By E. Shekarchi [1]

The Island of Cyprus remained divided into a northern sector controlled by the Federated Turkish Cypriots and a southern sector controlled by the Government of Cyprus. The information in this chapter reflects primarily the southern sector since no information was available on the northern sector.

The economy of Cyprus continued to surge forward during 1980. The mineral industry contributed approximately 13% of the gross domestic product valued at $1.5 billion.[2] The Geological Survey Department (GSD) was preoccupied with the question of the future of mineral resources in Cyprus, especially after the substantial decrease of cupriferous pyrite reserves. For this reason the GSD, in parallel with its efforts to locate new massive sulfide deposits, initiated a detailed exploration program to investigate the economic potential of industrial nonmetallic minerals such as bentonite clays suitable for ceramics and bricks, limestone, umber, and strontium minerals. The Senior Mines Office, in its annual report, summarized the exploration activities of Cyprus by stating that 62 licenses were issued covering copper, chromite, clays, silicon sands, and gypsum.

In 1980, there were some amendments both to the mines and quarries regulations of 1958 and to the explosive substance regulations of 1940, whereby the rent and fee was to be increased to conform to the present conditions.

The Cyprus Electricity Authority was undertaking a feasibility study into the practicability of using coal in the second phase of the Dhekelia power station, which was to be built in mid-1985. The two 60-megawatt units built in early 1980 were oil-fired. The study was to determine whether dual-source fueling arrangements would be possible. The study was a prerequisite of the $16 million to be provided by the World Bank.

The Bureau de Recherches Géologiques et Minières (BRGM) of France carried out a considerable amount of exploration under the mining leases of Kampia Mines Ltd. as a result of an agreement between the two organizations. During the year, BRGM's activity included basic geological mapping and drilling of 1,100 meters in 14 holes. No results of these activities were available by the yearend.

PRODUCTION AND TRADE

The pattern of mineral output in Cyprus in 1980 was generally similar to that of 1979. Production of chromite, asbestos, and clay minerals remained similar to those of previous years, whereas the output of cement showed a considerable increase. Mineral production statistics are given in table 1.

Cyprus' mineral trade imbalance, which was double that of 1979, continued into 1980 because of low prices for copper and higher prices for petroleum in the world market. Major mineral export earners were cement, asbestos, copper concentrates, chromite, and mineral pigments. The United Kingdom remained the major trading partner, whereas the European Economic Community was the largest supplier of imports.

Table 1.—Cyprus: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Chromium ore and concentrate, marketable	9,156	14,231	15,339	15,742	16,280
Copper, mine output, metal content[3]	8,000	6,800	5,786	1,200	--
Zinc, mine output, metal content	867	179	--	--	--
NONMETALS					
Asbestos	34,518	36,684	34,342	35,472	34,397
Cement, hydraulic thousand tons	1,026	1,071	1,107	1,135	1,233
Clays, crude:					
Bentonite	5,080	13,200	8,500	6,669	23,000
Other:					
For brick and tile manufacture thousand tons	102	132	[e]200	[e]200	683
For cement manufacture do.	171	444	272	274	
Gypsum:					
Crude	54,379	73,312	50,700	46,100	43,550
Calcined	10,241	10,544	18,100	15,300	17,850
Lime, hydrated	31,902	28,262	15,000	[e]18,000	13,984
Mineral pigments:					
Umber[e]	20,300	27,400	29,695	26,000	20,000
Yellow ocher	[4]344	[r]273	305	293	200
Salt, marine	3,318	--	--	--	7,462
Stone, sand and gravel:					
Dimension stone: Marble	28,450	34,500	38,400	52,700	66,200
Crushed and broken stone:					
Havara thousand tons	793	813	1,000	1,980	[e]1,900
Limestone:					
For cement production	712,166	865,458	976,443	993,000	[e]990,000
Other	4,771	4,567	18,400	[e]20,000	[e]20,000
Marl, for cement production	651,537	685,901	646,111	633,000	600,000
Unspecified building stone	44,700	46,700	63,000	50,000	100,000
Sand and aggregate thousand tons	2,134	3,353	3,972	4,000	4,200
Sulfur, S content of marketable pyrite	95,000	80,898	63,000	65,000	28,847
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	644	763	793	850	857
Jet fuel and kerosine do.	281	319	296	296	434
Distillate fuel oil do.	748	830	910	986	1,141
Residual fuel oil do.	790	829	861	1,334	1,415
Other:					
Liquefied petroleum gas do.	155	202	204	256	239
Asphalt do.	78	93	97	110	100
Unspecified do.	1	--	45	32	3
Refinery fuel and losses do.	179	196	130	198	188
Total do.	2,876	3,232	3,336	4,062	4,377

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Sept. 29, 1981.

[2]In addition to the commodities listed, a variety of other crude construction materials is produced, but available information is inadequate to make reliable estimates of output levels.

[3]Includes the nonduplicative sum of Cu content of all exportable products, including copper concentrates, cuprous pyrites, cement copper, and copper precipitates.

[4]Exports.

Table 2.—Cyprus: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal:				
Scrap	189	183	NA	NA.
Semimanufactures	176	152	NA	NA.
Chromium ore and concentrate	11,148	10,699	--	Austria 3,449; Poland 2,999; Spain 2,150.
Copper:				
Ore and concentrate	26,225	12,302	--	Spain 9,552; U.S.S.R. 2,750.
Metal scrap including alloys:				
Scrap	184	348	--	Belgium 113; West Germany 99; Spain 56.
Semimanufactures _ kilograms	896	112	NA	NA.
Gold metal including alloys, unwrought and partly wrought _ value	$23,420	--		
Iron and steel metal:				
Scrap	6,215	9,312	NA	NA.
Semimanufactures:				
Bars, rods, angles, shapes, sections	15	24	NA	NA.
Universals, plates, sheets	7	18	NA	NA.
Tubes, pipes, fittings	r51	167	NA	NA.
Unspecified	10	68	NA	NA.
Zinc metal including alloys, scrap	13	46	NA	NA.
NONMETALS				
Abrasives, n.e.s.: Natural pumice	74	12	NA	NA.
Asbestos, crude	29,338	39,107	--	United Kingdom 7,662; Thailand 6,351; Denmark 6,348.
Cement	595,014	617,779	--	Syria 567,709; Lebanon 14,363; Saudi Arabia 13,230.
Clays, crude	3,773	6,487	NA	Iraq 1,778; Egypt 1,165; Finland 1,118.
Fertilizer materials, manufactured kilograms	448	--		
Gypsum and plaster	7,696	9,640	NA	Malawi 5,080; United Arab Emirates 2,208; Kuwait 1,016.
Lime	789	80	NA	NA.
Pigments, mineral: Natural, crude	10,663	10,383	NA	NA.
Pyrite (gross weight)	123,672	143,224	--	Yugoslavia 57,582; Greece 41,819; Egypt 33,458.
Salt	202	281	NA	NA.
Stone, sand and gravel:				
Dimension stone, crude and partly worked, calcareous	282	246	NA	NA.
Gravel and crushed rock	36	75	NA	NA.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor thousand 42-gallon barrels	6,546	--		
Lubricants _ do	1,039	1,678	NA	Lebanon 1,535; Syria 115.
Unspecified _ value	$37,662	$5,588	NA	Mainly to Lebanon.

rRevised. NA Not available.

Table 3.—Cyprus: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	3,006	4,187	26	Greece 1,251; Switzerland 555; Israel 429.
Copper:				
Sulfate	6	5	--	Mainly from United Kingdom.
Metal including alloys, all forms	344	460	3	Greece 110; United Kingdom 97; Italy 95.
Gold metal including alloys, unwrought and partly wrought, troy ounces	25,156	26,127	1,012	United Kingdom, 19,667; West Germany 5,314.
Iron and steel metal:				
Scrap	(1)	3	NA	NA.
Pig iron, ferroalloys, similar materials	1,766	1,073	NA	U.S.S.R. 1,000; France 33; West Germany 20.
Steel, primary forms	3	56	--	Mainly from United Kingdom.
Semimanufactures:				
Bars, rods, angles, shapes, sections	74,442	114,656	44	Spain 23,814; West Germany 19,319; Greece 17,405.
Universals, plates, sheets	14,882	15,016	NA	Greece 5,893; Italy 1,646; Poland 1,139.
Hoop and strip	1,949	3,371	NA	Greece 1,120; Italy 1,088; Bulgaria 956.
Rails and accessories	21	--		
Wire	2,530	4,349	NA	United Kingdom 972; Greece 829; Belgium 664.
Tubes, pipes, fittings	13,996	20,640	5	Greece 5,014; Hungary 2,332; Italy 1,909.
Castings and forgings, rough	15	4	NA	NA.
Lead:				
Oxide and hydroxide	167	105	NA	United Kingdom 97; France 8.
Metal including alloys, all forms	358	713	22	Belgium 191; Denmark 171; United Kingdom 170.
Manganese oxide and hydroxide	6	2	NA	Mainly from Netherlands.
Nickel metal including alloys, all forms	3	9	NA	NA.
Platinum-group metals including alloys, unwrought and partly wrought, troy ounces	21	109	NA	NA.
Silver metal including alloys, unwrought and partly wrought, do.	353,285	299,378	NA	NA.
Tin metal including alloys, all forms	198	9	NA	NA.
Titanium oxide	272	368	NA	United Kingdom 182; West Germany 124; Belgium 36.
Zinc:				
Oxide and hydroxide	12	9	NA	NA.
Metal including alloys, all forms	62	240	NA	NA.
Other:				
Ores and concentrates:				
Of base metals	10	29	NA	NA.
Of precious metals except gold value	--	$13,839	--	Mainly from Australia.
Ash and residue containing nonferrous metals, do.	$691	$1,566	NA	United Kingdom $646.
Base metals including alloys, all forms	(1)	5	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	44	36	--	Mainly from Italy.
Grinding and polishing wheels and stones value	$199,828	$216,998	NA	Italy $89,731; West Germany $31,448; United Kingdom $28,818.
Asbestos, crude	202	545	--	West Germany 508; Switzerland 37.
Boron materials: Borates and perborates	2	7	NA	NA.
Cement	9,103	11,265	--	Italy 6,626; United Kingdom 2,351; Greece 1,797.
Chalk	668	923	NA	United Kingdom 683; Greece 178; France 58.
Clays:				
Crude	1,182	2,054	NA	Greece 1,805; United Kingdom 89; Netherlands 80.
Products:				
Refractory including nonclay brick value	$939,117	$926,739	NA	West Germany $298,647; Greece $188,340; France $161,890.
Nonrefractory value, thousands	$3,816	$6,709	NA	Italy $5,333; Greece $588; United Kingdom $508.
Diamond, gem, not strung or set, value	$127,005	$148,285	NA	United Kingdom $96,699; Belgium $37,888.
Diatomite and other infusorial earth	137	117	73	NA.

See footnotes at end of table.

Table 3.—Cyprus: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude ---------- value	$19	$5,808	--	Netherlands $5,658; Belgium $150.
Manufactured:				
Nitrogenous ----------	15,414	19,669	NA	Poland 6,625; Romania 4,001; Yugoslavia 3,519.
Phosphatic ----------	1,092	3,009	--	Lebanon 2,500; Portugal 501.
Potassic ----------	606	1,038	NA	Israel 936; Portugal 100.
Other including mixed ----------	17,706	38,326	29	France 16,442; Romania 10,489; Italy 2,499.
Ammonia ----------	52	15	NA	Netherlands 5; Israel 4; United Kingdom 4.
Gypsum and plaster ----------	30	21	NA	NA.
Lime ----------	(1)	223	--	All from Italy.
Pigments, mineral: Iron oxides, processed ---	42	32	NA	NA.
Precious and semiprecious stones, except diamond:				
Natural ---------- value	$102,519	$133,018	NA	NA.
Manufactured ---------- do	$33,013	$19,923	NA	NA.
Salt and brine ----------	6,447	714	NA	NA.
Sodium and potassium compounds, n.e.s.:				
Caustic soda ----------	398	446	NA	United Kingdom 262; Spain 53; France 50.
Caustic potash, and sodic and potassic peroxides ----------	3	21	NA	NA.
Soda ash ----------	418	495	NA	United Kingdom 299; West Germany 120; France 73.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked ----------	1,761	2,533	--	Italy 1,747; Greece 677.
Worked ---------- value	$119,623	$462,822	NA	Italy $344,702; Greece $69,489; Taiwan $17,448.
Quartz, mica, feldspar, etc ---------- do	$3,915	$25,610	NA	NA.
Gravel and crushed rock ----------	765	1,113	NA	NA.
Sand, excluding metal-bearing ----------	546	328	NA	NA.
Sulfur:				
Elemental excluding colloidal ----------	1,443	1,547	NA	Lebanon 1,211; Portugal 203; Poland 122.
Sulfuric acid ----------	472	278	NA	Greece 259.
Talc, steatite, soapstone, pyrophyllite ------	281	518	NA	Greece 423; Italy 50; Norway 29.
Other:				
Crude ---------- value	$37,600	$22,494	NA	NA.
Halogens and sulfur compounds of metals kilograms	51	457	NA	NA.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals value, thousands	$1,435	$1,025	NA	Greece $965; Italy $44.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black ----------	2	4	NA	West Germany 2.
Coal and briquets:				
Anthracite, bituminous coal, lignite ----	55	55	NA	NA.
Briquets ----------	25	17	NA	NA.
Coke and semicoke ----------	120	125	--	All from West Germany.
Hydrogen, helium, rare gases ----------	9	4	NA	NA.
Peat including briquets and litter ----------	354	575	--	West Germany 286; Ireland 169; Hungary 45.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	3,352	3,546	--	All from Iraq.
Refinery products:				
Gasoline including natural -- do	9	19	NA	Greece 11; Italy 6.
Kerosine and jet fuel ---------- do	243	349	--	Italy 202; France 81; Greece 43.
Distillate fuel oil ---------- do	113	103	--	People's Democratic Republic of Yemen 43; France 31.
Residual fuel oil ---------- do	1,944	1,685	--	U.S.S.R. 1,226; Sudan 379.
Lubricants ---------- do	46	62	(1)	United Kingdom 23; Netherlands 19; Greece 7.
Other:				
Mineral jelly and wax -- do	1	2	NA	NA.
White spirit ---------- do	5	5	--	Netherlands 4; United Kingdom 1.
Liquefied petroleum gas -- do	140	111	NA	Greece 56; Italy 36; Libya 19.
Unspecified ---------- do	9	8	NA	United Kingdom 3; Greece 2; Netherlands 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ---------- value	$2,023	$32,501	NA	NA.

NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromite.—Production of chromite by Hellenic Mining Co. Ltd., the sole producer, was from two mines; Kannoures chrome mine and Kokkinorotsos Mine, which were located in the Troodos Mountains. Shipments of hard lumpy chrome ore amounted to about 6,000 tons, and of chrome concentrates approximately 16,000 tons, which represented 80% of the rated capacity of the concentrator located at Aylos Nikolaos. The recipients of Cyprus chromite during the year were Spain, Austria, Poland, and Italy. Cyprus produced both refractory-grade and metallurgical-grade ore during the year. Italy received most of the refractory-grade shipments. Although chromite mine capacity was given at 40,000 tons per year, Cyprus was unable to achieve this production level because of limited concentrator capacity and other infrastructure problems such as transportation on the island.

NONMETALS

Asbestos.—Cyprus Asbestos Mines Ltd. remained the sole asbestos producer in Cyprus during 1980. Combined production of short- and long-fiber asbestos was about 34,000 tons, of which about 20,000 tons were long-fiber. Approximately 95% of production was exported to Western European nations, leading with Denmark, Greece, Italy, and Belgium. Construction of a new plant at Limassol remained at the planning stage because of difficulties with financial arrangements. Total work force in the asbestos industry was about 500 people during 1980, of which approximately 100 were paid monthly and the remaining were paid daily.

Cement.—Cyprus produced over 1.2 million tons of both cement and clinker in 1980. This output was nearly the full rated capacity of Vassiliko Cement Works Ltd., which used 990,000 tons of limestone, 1,600 tons of marl, 280,000 tons of clay, and about 25,000 tons of gypsum. Approximately 380 people were employed in cement manufacturing, of which 280 were paid daily and the remaining were monthly employees.

Clays.—Cyprus produced a variety of clays in 1980, some for domestic consumption and others for export to overseas markets. Bendex Minerals Co. Ltd. produced about 5,000 tons of bentonite, which was processed and activated in the company's plant for export. Because of the strong vitalization of the building industry on the island, there was a shortage of some quarried materials including bricks, sand and gravel, and aggregates. To overcome the shortage, several new quarries came into production to replace the production lost since the Turkish occupation of the north in 1974.

Fertilizer Material.—Cyprus continued to be an importer of fertilizer materials during 1980. The planned Hellenic Chemical Industries Ltd.'s new fertilizer plant continued to be under construction and was expected to go into operation in 1982. Annual production capacity of the facility will be 180,000 tons of sulfuric acid, 150,000 tons of complex fertilizer material, and 40,000 tons of phosphoric acid. Imports of fertilizer material to Cyprus exceeded $10 million during 1980.

Gypsum.—Total gypsum production was about 100,000 tons, shared among United Gypsum Ltd., Peletico Ltd., and Limassol Chemical Products Ltd. There was also some production by small private producers that was difficult to estimate because of seasonal work and unreported production figures. United Gypsum Ltd. operated Psematismenos quarry, which had a mining capacity of 40,000 tons; Peletico Ltd. operated a quarry near Larance with a 30,000-ton capacity; and Limassol operated several small quarries with a total capacity of 30,000 tons. About 25,000 tons of gypsum was used in cement manufacturing and, aside from a few thousand tons that were exported to Middle Eastern countries, the remaining production was consumed domestically in the building industry.

MINERAL FUELS

Petroleum.—The only refinery on the island, Cyprus Petroleum Refinery Ltd., operated at less than its capacity of 16,000 barrels per day. The refinery, owned by Shell Oil Co. (25.5%), British Petroleum Co. Ltd. (25.5%), Mobil Oil Co. (34%), and the Cyprus Government (15%), imported most of the crude oil for the refinery's feedstock from Algeria, Libya, and Saudi Arabia. Algerian crude used by the refinery lacked the high heavy fuel components; therefore, the refinery did not produce substantial

amounts of heavy fuel and the Government was forced to purchase this grade of refinery product from the Soviet Union. However, because of conditions of the trade agreements with the Soviets, the Cyprus Government was obliged to pay higher prices for heavy fuel oil during 1980.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Cyprus pounds (LC) to U.S. dollars at the rate of LC1 = US$2.83.

The Mineral Industry of Czechoslovakia

By Tatiana Karpinsky[1]

Czechoslovakia is one of the most industrially advanced countries in East Europe; however, the country is not self-sufficient in raw materials and fuels.

The growth rate of Czechoslovakia's economy was considerably slower in 1980 than in 1979. The planned targets were unfulfilled in several sectors of the industry. According to Czechoslovakia's sources, in 1980 national income increased 3% (planned 3.7%) over that of 1979, reaching 453.6 billion korunas (Kcs).[2] The gross industrial production increased 3.2% (planned 3.5%) over that of 1979.[3] In 1979, the value of total industrial output was Kcs617 billion. Capital investment in the economy increased 1.2% in 1980, while the planned increase for 1980 was 2%.

Important projects completed in 1980 included the second unit of the nuclear powerplant at Jaslowske Bohunice, the 500-megawatt set at the Melnik-3 thermal power station, and an additional section of the transit gas pipeline.

In 1979, mining and quarrying contributed 4.3% of the total industrial production in Czechoslovakia, of which the share of coal was 3.2%; crude oil, 0.1%; metallic ore, 0.5%; and other mining, 0.5%.[4] In 1979, production of petroleum refinery contributed 3.9% to the total industrial output, the iron and steel industry contributed 9.4%, the nonferrous industry contributed 2.5%, and production of the nonmetallic mineral industry was 2.7%. Contribution of mining and quarrying to the total industrial production in 1980 was approximately the same as in 1979.

The number of industrial workers employed in state enterprises in Czechoslovakia totaled 2,896,000 in 1979, and the number of employees totaled 2,008,000.[5] The number of workers and employees in state mineral and energy enterprises by branch (in thousands) follows:

Branch	Workers	Employees	Number of enterprises
Fuel extraction and processing industry	175	136	55
Power and heat generation	56	37	27
Ferrous metallurgy (including ore mining)	168	124	14
Nonferrous metallurgy (including ore mining)	42	30	20

According to Czechoslovakia's sources, during the 5-year plan period (1976-80) the national income of the country increased 20% and industrial production increased 25%.[6]

The original 5-year plan (1976-80) called for a 29% increase in national income and a 34% increase in gross industrial output. Capital investment yielded a considerable increase in basic assets, which were estimated at Kcs628 billion for the entire 5-year plan. New capacities went into operation for the extraction of 13 million tons of coal, for the production of 245,000 tons of steel pipes, for powerplants with total generating capacity of 4,500 megawatts, and for production of other commodities.

The sixth 5-year plan (1976-80) was not implemented. Nonfulfillment of the plan started at the end of 1979 in the strip mines of the North Bohemian brown coal basin at Most and also in the several sectors of the metallurgical industry where supplies of iron ore, raw materials, and metallurgical coke were smaller than expected. During the period of 1976-80, results were inadequate in saving or more effective utilization

of energy, raw materials, and semifinished products.

Government Policies and Programs.— The targets for the seventh 5-year plan (1981-85) were approved by the 16th Congress of the Communistic Party of Czechoslovakia in April 1981.

In the seventh 5-year plan the national income is to increase 14% to 16%. About 90% to 95% of the growth in national income is to be achieved by increased labor productivity. The plan also calls for an 18% to 20% increase in gross industrial output. The basic economic policy target for the seventh 5-year plan is the improvement of the quality and efficiency of industrial output and to make substantially better use of all kinds of fuels and energy, raw materials, capital assets, and labor. The new 5-year plan calls for increasing Czechoslovakia's participation in the Council for Mutual Economic Assistance (CMEA) country division of labor, particularly with the U.S.S.R.

According to the plan outlined at the 16th Party Congress for 1985, the brown coal and lignite output is to be 99 to 100 million tons, and bituminous coal is to be 27 to 28 million tons; electric energy production is planned to be 80,000 million to 83,000 million kilowatt-hours, including 15,000 million kilowatt-hours generated at nuclear powerplants. Steel production is to reach about 16 million tons by 1985. During the 5-year plan period a special effort is to be put on the production of equipment for nuclear, thermal, and hydroelectric powerplants.

The 1981 annual plan foresees an increase in national income of 2.8%. The plan calls for a 2.7% increase in gross industrial output with a 0.7% growth in the coal industry, 1.1% in electric energy, about 3% in the steel industry, 2.7% in rolled ferrous products, and 5.6% in the cement industry.

New production facilities coming onstream in 1981 include a new high-capacity, medium-gage rolling mill at NHKG Kunice, with an annual production capacity of 600,000 tons, and a new blooming and billet mill at SONP Kladno, with an annual production capacity of 900,000 tons. Greater utilization of metal waste and scrap and considerably better organization of collection of waste and scrap metals remains an urgent task. The plan calls for achieving relative savings of not less than 4% in consumption of ferrous metals and a 0.5% decrease in consumption of fuel and energy. Consumption of copper, zinc, and aluminum per unit of product is to decrease more substantially.

PRODUCTION

In Czechoslovakia there are reserves of coal, lignite, antimony, magnesite, mercury, uranium, graphite, kaolin and other clays, sand, limestone, and building materials, but the country remains deficient in oil, natural gas, iron ore, and nonferrous ores.

The state plan of bituminous coal extraction was fulfilled in 1980, but brown coal and lignite mining fell by 1.5% below the plan. There were problems in meeting planned extraction goals in the North Bohemian lignite mines at Most. In 1980, overall production in the metallurgical industry increased 1.2% over that of 1979, while production of nonferrous metals remained approximately at the 1979 level. Oil refining production and nitrogenous fertilizer production slightly increased in 1980. Labor productivity in industry increased by only 2.5% compared with a 2.9% increase in 1979. Despite a certain improvement, the efficiency of the economy was not increasing as fast as planned; there was no distinct reduction on the consumption of raw materials and energy. Electrical energy was increased by the higher output of nuclear power and hydroelectric plants. Nuclear power generated 4.5 billion kilowatt-hours, 2.4 billion kilowatt-hours more than in 1979, and hydroelectric energy increased by 14%.

Table 1.—Czechoslovakia: Production of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Alumina[e]	90,000	95,000	100,000	100,000	100,000
Aluminum ingot, primary only	36,019	36,544	36,823	36,889	38,304
Antimony:					
Mine output, metal content	e285	e300	e300	408	410
Metal[e]	700	700	700	NA	NA
Copper:					
Mine output, metal content	r4,900	r5,400	4,700	6,180	6,200
Metal:					
Smelter, primary only	r6,900	r7,400	6,700	8,180	7,600
Refined including secondary	22,052	23,067	23,810	24,587	25,559
Iron and steel:					
Iron ore:					
Gross weight thousand tons	1,904	1,994	2,023	2,012	1,927
Metal content do	573	598	607	548	525
Metal:					
Pig iron do	r9,475	9,715	9,944	9,529	9,819
Ferroalloys:					
Blast furnace do	2	--	--	--	--
Electric furnace do	140	180	182	175	170
Crude steel do	14,693	15,064	15,294	14,817	15,225
Semimanufactures:					
Rolled steel do	10,392	10,588	10,787	10,781	10,760
Pipes and tubes do	1,461	1,483	1,510	1,586	1,570
Lead:					
Mine output, metal content	4,183	4,300	3,981	4,026	3,349
Metal including secondary	19,116	19,015	19,042	19,020	20,014
Manganese ore, gross weight[3]	1,099	910	900	900	900
Mercury 76-pound flasks	r5,540	r5,309	5,686	4,960	4,612
Nickel metal, primary	r e2,200	r e2,200	r e2,200	2,202	2,241
Silver[e] thousand troy ounces	1,190	1,192	1,300	1,300	1,300
Tin:					
Mine output, metal content	180	180	180	180	180
Metal including secondary	120	120	120	120	125
Tungsten, mine output, metal content[e]	80	80	80	80	80
Zinc:					
Mine output, metal content	9,269	9,368	8,772	8,799	7,239
Metal including secondary	e11,500	e11,500	e11,500	11,500	9,600
NONMETALS					
Barite	r e60,000	r e65,000	r e65,000	67,800	61,052
Cement, hydraulic thousand tons	9,552	9,749	10,204	10,258	10,546
Clays: Kaolin do	545	580	499	513	530
Fluorspar[e]	93,000	96,000	96,000	96,000	96,000
Gypsum and anhydrite, crude thousand tons	660	682	697	734	757
Lime, hydrated, and quicklime do	2,986	3,021	3,078	2,968	3,018
Magnesite, crude do	654	661	658	654	666
Nitrogen: N content of ammonia do	r725	791	812	768	e803
Perlite	e10,000	e10,000	r e20,000	r e30,000	40,302
Pyrite, gross weight thousand tons	111	122	134	140	e140
Salt do	244	254	258	271	e270
Sodium compounds:					
Caustic soda do	293	312	311	312	e312
Sodium carbonate, manufactured do	119	118	121	119	123
Stone:					
Limestone and other calcareous stone do	22,312	22,761	23,174	22,210	25,000
Quarry stone, not further described thousand cubic meters	32,244	32,990	34,368	35,192	35,500
Sulfur:[e]					
Native thousand tons	12	5	5	5	5
From pyrite do	50	55	60	60	60
Byproduct, all sources do	10	9	10	10	10
Total do	72	69	75	75	75
Sulfuric acid do	1,240	1,276	1,200	1,160	1,160
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	30,000	30,000	30,000	30,000	30,000
Coal:					
Bituminous thousand tons	27,737	27,450	27,799	27,967	e27,600
Brown do	86,838	90,696	92,450	93,731	e92,500
Lignite do	3,488	3,354	3,269	3,201	e3,000
Total do	118,063	121,500	123,518	124,899	123,100

See footnotes at end of table.

Table 1.—Czechoslovakia: Production of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coke:					
Metallurgical thousand tons	9,007	8,816	8,809	8,569	8,445
Unspecified do	1,886	2,045	1,976	1,889	1,878
Total do	10,893	10,861	10,785	10,458	10,323
Fuel briquets from brown coal do	1,311	1,255	1,130	1,117	1,159
Gas:					
Manufactured, all types million cubic feet	281,571	279,094	282,136	275,983	274,323
Natural, marketed[4] do	33,641	35,355	26,129	[e]26,000	[e]26,000
Petroleum:					
Crude:					
As reported thousand tons	131	123	117	108	93
Converted thousand 42-gallon barrels	888	834	793	732	629
Refinery products:[5]					
Gasoline do	13,472	13,940	13,917	[e]14,157	[e]14,157
Kerosine do	2,310	2,612	3,658	[e]3,751	[e]3,751
Distillate fuel oil do	29,556	31,034	31,670	[e]32,065	[e]32,065
Residual fuel oil do	56,404	57,289	58,484	[e]59,290	[e]59,290
Lubricants do	1,792	1,960	[e]1,925	[e]1,936	[e]1,936
Other:					
Liquefied petroleum gas do	1,659	1,693	[e]1,720	[e]1,694	[e]1,694
Asphalt and bitumen do	7,932	7,836	[e]7,880	[e]7,986	[e]7,986
Paraffin wax do	110	[e]120	[e]120	[e]121	[e]121
Total do	113,235	116,484	119,374	[e]121,000	121,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 24, 1981.

[2]In addition to the commodities listed, arsenic, gold, uranium, feldspar, graphite, and a variety of other petroleum products are produced, but information is inadequate to make reliable estimates of output levels.

[3]This material, although reported as manganese ore, is believed to be manganiferous iron ore with an Mn content of about 17% and as such is not equivalent to material ordinarily reported as manganese ore, which generally contains 25% or more manganese.

[4]Includes gas produced from coal mines. Gross output of natural gas is not reported, but it is believed to exceed reported marketed output by a relatively inconsequential amount.

[5]Data presented are for those products reported in official Czechoslovak sources and in United Nations publications; no estimates have been included for other products or for refinery fuel and losses.

TRADE

In 1980, the value of total foreign trade turnover increased by 11% compared with that of 1979. The structure of Czechoslovakia's foreign trade for 1980 follows:

Country group	Exports		Imports	
	Million korunas	Percent	Million korunas	Percent
CMEA and other centrally planned economy countries	55,974	69.6	57,214	70.2
Developed countries	17,442	21.7	19,868	24.4
Developing countries	7,017	8.7	4,458	5.4
Total	80,433	100.0	81,540	100.0

Balance of Trade

Country group	Value of trade
CMEA and other centrally planned economy countries	-1,240
Developed countries	-2,426
Developing countries	+2,559
Total	-1,107

In 1980, the trade turnover increased at a faster rate with market economy countries than with centrally planned economy countries. The share of centrally planned economy countries in the total foreign turnover remained very high, at 69.9%. In 1980, Czechoslovakia's exports to market economy countries increased faster than imports. Czechoslovakia's participation in world trade dropped from 1.5% in 1965 to 0.9% in 1980, and its share of trade between CMEA countries decreased from 13% to 9.5% during the same period.

In 1979, exports of fuels, mineral raw materials, and metals contributed 16.9% to the total exports value and the share of this group of commodities in total imports accounted for 30.9%.

In 1980, almost 70% of all imports of fuels and raw materials, in terms of value, came from the centrally planned economy countries, especially from the U.S.S.R.

In 1980, the Soviet Union supplied Czechoslovakia with 18.8 million tons of oil, 7.7 billion cubic meters of natural gas, 1 million tons of cast iron, 3.2 million tons of bituminous coal, 2.2 billion kilowatt-hours of electric energy, and 89,000 tons of nonferrous metals, as well as chemical fertilizers and other commodities.

A large part of the deliveries of these products was supplied on the basis of credits granted Czechoslovakia for its participation in the enlargement of the facilities and the construction of new projects on the territory of the U.S.S.R. and in some other centrally planned economy countries. The surface mining, transportation, and processing equipment supplied by Czechoslovakia on credit made it possible to enlarge the capacity of the U.S.S.R. mining and metallurgical industry. The U.S.S.R. has been repaying the credit in annual deliveries of 20,000 tons of aluminum, 15,000 tons of copper, 9,000 tons of lead, 6,000 tons of zinc, and 1.8 million tons of iron ore concentrate.[7]

Czechoslovakia's participation in the construction of the Soyuz gas pipeline secured annual supplies of 2.8 billion cubic meters of gas for 20 years.

In 1980, Czechoslovakia continued to participate in the construction of a nuclear powerplant in Khmelnitsky in the Ukraine, which will supply it with 3,600 million kilowatt-hours of electric energy annually after completion. The Soviet Union is to export to Czechoslovakia 8.7 billion cubic meters of natural gas in 1981. The contract was signed in Prague by representatives of Metalimex of Czechoslovakia and Soyuzgasexport of the U.S.S.R.[8]

Ferromet and the Soviet foreign trade organization Promsyryoexport signed contracts for 1981 for the delivery to the U.S.S.R. of about 300,000 tons of pipes made in Czechoslovakia, of which 184,000 tons are to be used for oil and gas.

In 1980, a large amount of alloy steel made by Poldi-SONP Kladno National Enterprise in Czechoslovakia, was exported to the French automobile industry.

The agreement for 1981-85 between Czechoslovakia and Cuba envisages an increase of 55% in the value of trade. Czechoslovakia is to take part in the construction of a nickel and cobalt enterprise at Los Camariocas, in the first Cuban nuclear power station at Cienfulgos, and also in two 250-megawatt thermal power stations.

A protocol on commodity exchanges and payments for 1981 between North Korea and Czechoslovakia was signed in October 1980. Czechoslovakia will mainly supply machinery and equipment and import zinc and other commodities from Korea.

In June 1980, Czechoslovakia and Vietnam signed a protocol on the exchange of goods and services for 1981-85 in Prague. The volume of mutual trade will be doubled compared with the 1976-80 period. Czechoslovakia is to supply rolled steel and machinery and import zinc, lead, tin, and other commodities from Vietnam.

A protocol on coordination of national economic plans of Czechoslovakia and Mongolia for 1981-85 was signed in Prague on June 19, 1980. Czechoslovakia will further participate in the development of Mongolian raw material resources and their processing. Mongolia is to export to Czechoslovakia metal concentrates from their new deposits.

Table 2.—Czechoslovakia: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Bauxite	215	--	
Oxide and hydroxide	61	60	All to Sweden.
Metal including alloys:			
Scrap	4,995	3,485	West Germany 2,177; France 656; Austria 495.
Unwrought	18,815	18,168	Japan 15,473; Hungary 1,663.
Semimanufactures	5,692	5,493	Poland 4,779; Hungary 661.
Antimony metal including alloys, all forms	90	105	All to Spain.
Chromium oxide and hydroxide	15	--	
Copper:			
Ore and concentrate	495	506	All to United Kingdom.
Sulfate	2,070	2,159	Italy 730; West Germany 490; Spain 300.
Metal including alloys:			
Scrap	663	1,261	West Germany 1,092.
Unwrought	10,285	7,847	All to West Germany.
Semimanufactures	3,174	942	Poland 900; West Germany 39.
Iron and steel:			
Ore and concentrate, thousand tons	7	--	
Pyrite, roasted, do.	--	3	All to Hungary.
Metal:			
Scrap, do.	114	124	Italy 90; West Germany 21; Austria 13.
Pig iron, do.	[3]23	4	Sweden 2; West Germany 1.
Ferroalloys, do.	35	31	West Germany 14; Austria 7; United Kingdom 3.
Steel, primary forms[4], do.	521	484	Yugoslavia 199; Italy 122; Spain 54; Hungary 36.
Semimanufactures:			
Bars, rods, angles, shapes, sections[5], do.	1,138	1,193	West Germany 156; East Germany 88; Egypt 48.
Universals, plates, sheets, do.	[4]908	[5]923	West Germany 101; Yugoslavia 91; France 83; Poland 61.
Hoop and strip[5], do.	225	213	West Germany 19; Yugoslavia 12.
Rails and accessories[5], do.	18	16	NA.
Wire[5], do.	119	117	Hungary 18; West Germany 16.
Tubes, pipes, fittings[4], do.	549	553	U.S.S.R. 400; East Germany 21; Poland 20.
Castings and forgings, rough[5], do.	43	34	Poland 5.
Unspecified[4], do.	1,519	1,320	Yugoslavia 336; East Germany 245; Italy 188; West Germany 154.
Lead:			
Ore and concentrate	7,088	7,133	West Germany 5,214; Belgium-Luxembourg 1,919.
Metal including alloys:			
Scrap	176	89	All to West Germany.
Unwrought	9	--	
Semimanufactures	11	--	
Magnesium metal including alloys:			
Scrap	24	--	
Semimanufactures, kilograms	--	327	All to Yugoslavia.
Manganese metal including alloys, all forms	65	--	
Molybdenum metal including alloys, all forms	4	--	
Nickel metal including alloys:			
Scrap	302	634	Austria 483; West Germany 151.
Semimanufactures	44	--	
Platinum-group metals including alloys, unwrought and wrought, value, thousands	$74	$694	All to United Kingdom.
Silver:			
Waste and sweepings, do.	$683	$14	All to West Germany.
Metal, unwrought and wrought, do.	$63	$1	All to Spain.
Tin:			
Ore and concentrate	111	92	All to West Germany.
Metal including alloys, unwrought, kilograms	--	18	All to Yugoslavia.
Titanium oxide	2,833	2,406	United Kingdom 738; Italy 455; Turkey 435.
Tungsten:			
Ore and concentrate	67	36	All to United Kingdom.
Metal including alloys, all forms, kilograms	[r]1,910	--	
Zinc:			
Ore and concentrate	11,518	11,472	West Germany 6,690; Belgium-Luxembourg 4,782.
Oxide and peroxide	256	701	Norway 280; Saudi Arabia 222.
Metal including alloys:			
Scrap	165	617	All to West Germany.
Unwrought	--	41	United Kingdom 36.
Semimanufactures	NA	135	All to Saudi Arabia.
Zirconium metal including alloys, all forms, kilograms	--	2	All to Japan.

See footnotes at end of table.

Table 2.—Czechoslovakia: Apparent exports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Other:			
Ash and residue containing nonferrous metals	7,174	10,613	West Germany 6,304; Austria 3,888.
Oxides, hydroxides, perioxides	r5	21	United Kingdom 18.
Base metals including alloys, all forms	r15	20	United Kingdom 19.
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	87	88	Hungary 50; Sweden 20.
Artificial corundum	NA	4,939	Italy 2,906; United States 523.
Grinding and polishing wheels and stones	r754	516	West Germany 134; Italy 113; France 66.
Asbestos	--	16	All to United Kingdom.
Barite and witherite	8,541	5,478	West Germany 4,451; Austria 787.
Cement[4] thousand tons	286	303	West Germany 79; Poland 66; Yugoslavia 40.
Clays and clay products:			
Crude clay:			
Fire clay do	33	36	All to Yugoslavia.
Fuller's earth and chamotte do	134	122	Hungary 67; West Germany 33; Italy 18.
Kaolin[4] do	382	382	West Germany 127; Poland 62; Austria 60.
Other do	196	183	West Germany 110; Hungary 50; Yugoslavia 11.
Clay products:			
Refractory do	r64	56	West Germany 30; Sweden 10; Poland 6.
Nonrefractory do	18	24	Yugoslavia 12; Austria 3; West Germany 3.
Diamond:			
Gem, not set or strung value, thousands	$685	$12	All to Egypt.
Industrial do	$125	$108	All to Belgium-Luxembourg.
Diatomite and other infusorial earth	706	1,026	Austria 828.
Fertilizer materials:			
Crude, nitrogenous	28	--	
Manufactured:			
Nitrogenous thousand tons	r221	242	Hungary 140; Yugoslavia 38; West Germany 18.
Phosphatic	--	40	All to Italy.
Potassic	351	--	
Other including mixed	578	1,614	Ivory Coast 1,429.
Ammonia	6,837	1,198	All to West Germany.
Graphite, natural	509	768	Yugoslavia 678.
Lime	24,997	15,261	Hungary 15,248.
Magnesite[4] thousand tons	382	377	Hungary 82; West Germany 62; Poland 58; East Germany 58.
Mica, worked	94	105	Yugoslavia 45; United Kingdom 30.
Pigments, mineral: Iron oxides, processed	r1,949	1,424	Italy 979; Yugoslavia 430.
Precious and semiprecious stones:			
Natural value, thousands	r$33	$37	Singapore $30.
Synthetic do	$80	$269	Hong Kong $203; Canada $26.
Salt	8,692	744	All to Hungary.
Sodium and potassium compounds, n.e.s.:			
Caustic soda[3]	r25,700	18,100	Yugoslavia 12,799;[4] West Germany 2,342.
Caustic potash	445	547	Yugoslavia 191; Italy 130.
Soda ash[3]	16,800	19,700	West Germany 19,647.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	1,666	2,183	West Germany 2,009.
Worked	5,534	4,661	West Germany 4,438.
Dolomite	11	--	
Gravel and crushed rock	72,204	74,214	All to Hungary.
Limestone, except dimension	22,754	22,800	All to West Germany.
Quartz and quartzite	63	--	
Sand, excluding metal-bearing	314,160	398,071	Austria 210,205; Hungary 92,922.
Sulfur, elemental, other than colloidal	32	560	All to Austria.
Talc	6,665	6,720	Poland 6,690.
Other:			
Crude	29,869	25,489	Hungary 11,856; West Germany 9,350.
Slag, dross, similar waste	21,009	21,514	All to West Germany.
Halogens	--	205	Yugoslavia 183.

See footnotes at end of table.

Table 2.—Czechoslovakia: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	8	18	All to Austria.
Coal, all grades including briquets:			
Anthracite and bituminous[4] thousand tons	3,745	3,366	Yugoslavia 656; East Germany 651; Hungary 571; Austria 508.
Briquets of anthracite and bituminous coal do	284	(6)	All to Greece.
Lignite and lignite briquets[4] do	1,991	1,647	West Germany 1,598.
Coke and semicoke[4] do	1,515	1,892	East Germany 793; Austria 458; Hungary 281.
Gas, natural[3] million cubic feet	2,988	2,341	NA.
Peat and peat briquets	169	19	All to France.
Petroleum and refinery products:			
Crude[3] thousand 42-gallon barrels	2,308	178	NA.
Refinery products:			
Gasoline[3] do	901	1,998	West Germany 893; France 303; Netherlands 273.
Kerosine do	150	285	West Germany 190; Austria 45; Yugoslavia 40.
Distillate fuel oil[3] do	1,112	1,455	West Germany 876; Austria 135.
Residual fuel oil do	75	124	Austria 110; West Germany 14.
Lubricants[3] do	53	50	Austria 34; Yugoslavia 4.
Other:			
Liquefied petroleum gas do	659	936	West Germany 698; Italy 141.
Mineral jelly and wax do	3	(6)	Mainly to Italy.
Bitumen and other residue do	10	7	All to Austria.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	35,528	33,460	West Germany 15,243; Italy 9,645; France 6,225.

[r]Revised. NA Not available.

[1]Owing to a lack of official trade data published by Czechoslovakia, this table should not be taken as a complete presentation of Czechoslovakia's mineral exports. These data have been compiled from various sources, which include United Nations information, data published by the partner trade countries, and partial official trade sources of Czechoslovakia.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Statistical Yearbook of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

[4]Official trade statistics of Czechoslovakia.

[5]United Nations. Quarterly Bulletin of Steel Statistics for Europe. New York.

[6]Less than 1/2 unit.

Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite[3] thousand tons	456	436	Hungary 328; Yugoslavia 108.
Oxide and hydroxide	25,836	29,036	Yugoslavia 19,707; Hungary 9,162.
Metal including alloys:			
Scrap	541	1	All from West Germany.
Unwrought[3] thousand tons	95	88	U.S.S.R. 65; Hungary 18.
Semimanufactures	20,662	19,967	Yugoslavia 16,032; Hungary 2,391.
Antimony ore and concentrate	--	290	All from France.
Cadmium metal including alloys, all forms[3]	369	251	Japan 124; Finland 50.
Chromium:			
Chromite[3] thousand tons	180	168	U.S.S.R. 128; Albania 15.
Oxide and hydroxide	502	520	All from U.S.S.R.
Cobalt:			
Oxide and hydroxide	16	13	United Kingdom 6; West Germany 6.
Metal including alloys, all forms	8	--	
Copper:			
Ore and concentrate	4,115	[4]587	All from Peru.
Metal including alloys:			
Scrap	332	172	All from West Germany.
Unwrought[3] thousand tons	56	58	U.S.S.R. 39; Poland 13.
Semimanufactures	24,462	23,645	West Germany 10,685; Poland 8,054.
Iron and steel:			
Ore and concentrate[3] thousand tons	15,600	12,459	U.S.S.R. 9,906; Brazil 1,240; Sweden 566.

See footnotes at end of table.

Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Iron and steel —Continued			
Metal:			
Scrap ---------- thousand tons	49	43	All from West Germany.
Pig iron[3] ---------- do	919	732	U.S.S.R. 729.
Ferroalloys ---------- do	5	5	West Germany 3.
Steel, primary forms[5] ---------- do	98	152	NA.
Semimanufactures:			
Bars, rods, angles, shapes, sections[5] ---------- do	174	97	NA.
Universals, plates, sheets[5] do	190	125	Hungary 15; West Germany 13; Bulgaria 10.
Hoop and strip[5] ---------- do	13	17	West Germany 3; Austria 1; Hungary 1.
Rails and accessories ---------- do	[5]8	([6])	All from Austria.
Wire[5] ---------- do	3	3	Italy 2; West Germany 1.
Tubes, pipes, fittings[5] ---------- do	164	226	West Germany 187.
Castings and forgings, rough[5] do	21	12	Poland 1; Hungary 1.
Lead:			
Ore and concentrate	1,949	--	
Oxide	3,748	3,992	France 2,317; Austria 1,654.
Metal including alloys:			
Scrap	--	2	All from West Germany.
Unwrought[3] ---------- thousand tons	39	40	U.S.S.R. 25; Yugoslavia 10.
Semimanufactures	2	6	All from Yugoslavia.
Magnesium metal including alloys:			
Scrap	--	1	All from West Germany.
Semimanufactures	2	9	West Germany 7.
Manganese:			
Ore and concentrate[3] ---------- thousand tons	526	541	U.S.S.R. 414; Brazil 67; India 39.
Oxide	--	15	All from United States.
Molybdenum:			
Ore and concentrate	630	431	Netherlands 258; West Germany 173.
Metal including alloys, all forms kilograms	1,085	132	All from United States.
Nickel metal including alloys:			
Unwrought[3] ----------	4,862	5,580	U.S.S.R. 4,746; United Kingdom 487; Cuba 334.
Semimanufactures	35	69	West Germany 34; Canada 14.
Niobium metal including alloys, all forms kilograms	--	126	All from West Germany.
Platinum-group metals including alloys, unwrought and wrought value, thousands	$860	$1,759	United Kingdom $922; West Germany $837.
Silver metal including alloys, unwrought and wrought ---------- do	$13,373	$3,966	Yugoslavia $3,054.
Tin metal including alloys; unwrought[3] ----------	3,894	3,940	United Kingdom 1,311; Bolivia 874; Indonesia 799.
Titanium:			
Ore and concentrate	--	219	All from West Germany.
Oxide	1,554	755	West Germany 612; Italy 123.
Metal including alloys, all forms kilograms	--	3,647	West Germany 3,600; Japan 47.
Tungsten:			
Ore and concentrate	362	72	All from Netherlands.
Metal including alloys, all forms ----------	2	2	Japan 1; United Kingdom 1.
Zinc:			
Oxide and peroxide ----------	240	260	All from United Kingdom.
Metal including alloys:			
Scrap ----------	198	--	
Unwrought[3] ---------- thousand tons	68	67	Yugoslavia 24; U.S.S.R. 21.
Semimanufactures ----------	5,872	7,376	Yugoslavia 5,921; Poland 1,455.
Zirconium ore and concentrate ----------	599	301	All from West Germany.
Other:			
Ores and concentrates	122,804	98,833	Algeria 98,552.
Ash and residue containing nonferrous metals	--	1	All from United Kingdom.
Oxides, hydroxides, peroxides ----------	529	291	Belgium-Luxembourg 141; United Kingdom 86.
Metals:			
Metalloids ----------	74,018	6,439	France 4,325; Norway 2,111.
Base metals including alloys, all forms	202	51	Austria 27; Japan 15.
Nonferrous metals including alloys, rolled[3] ----------	967	2,928	NA.
NONMETALS			
Abrasives n.e.s.:			
Natural: Pumice, emery, corundum, etc --	828	723	Italy 608; Belgium-Luxembourg 110.
Artificial corundum ----------	NA	2,182	Yugoslavia 2,134.
Dust and powder of precious and semiprecious stones, natural and synthetic value, thousands	$3	$474	United Kingdom $299; Switzerland $175.
Grinding and polishing wheels and stones	505	466	West Germany 228; Austria 185.

See footnotes at end of table.

Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Asbestos[3]	44,028	41,804	U.S.S.R. 25,468; Botswana 7,310; Canada 4,300.
Barite and witherite	100	140	All from West Germany.
Boron materials:			
Crude natural borates	10,390	8,590	Turkey 8,210; Netherlands 280.
Boric oxide and acid	3,436	3,666	France 2,285; Turkey 1,260.
Cement thousand tons	[3]555	[7]518	U.S.S.R. 321; Romania 130;[3] East Germany 70.[3]
Chalk	355	2,069	West Germany 1,239; Austria 176.
Clays and clay products:			
Crude clays:			
Kaolin	5,022	4,886	Hungary 4,881.
Other	1,042	2,618	United Kingdom 2,170; West Germany 385.
Clay products:			
Refractory	18,479	9,290	West Germany 3,872; Austria 1,548; France 1,535.
Nonrefractory	2,202	1,878	Italy 1,465; West Germany 284.
Diamond:			
Gem, not set or strung value, thousands	$939	$90	All from Belgium-Luxembourg.
Industrial do	$4,008	$3,288	Belgium-Luxembourg $2,513; United Kingdom $775.
Diatomite and other infusorial earth	1,133	246	Austria 116; France 105.
Feldspar and fluorspar	9,412	4,165	West Germany 2,005; Yugoslavia 1,151; France 1,009.
Fertilizer materials:			
Crude:			
Nitrogenous	227	--	
Phosphatic, P_2O_5 content[3] thousand tons	317	322	U.S.S.R. 171; Morocco 102; Tunisia 22.
Manufactured:			
Nitrogenous, N_2 content[3] do	59	47	All from U.S.S.R.
Phosphatic, P_2O_5 content[7] do	57	83	United States 33; Morocco 7; Yugoslavia 7.
Potassic, K_2O content[3] do	670	624	East Germany 483; U.S.S.R. 141.
Other including mixed	--	19	West Germany 17.
Ammonia	2,796	3,206	All from Hungary.
Graphite, natural	233	228	All from West Germany.
Gypsum and plasters[3] thousand tons	24	25	East Germany 24.
Iodine	--	24	All from France.
Lime	54	43	All from West Germany.
Magnesite	2,668	2,784	Greece 1,800; Austria 371; West Germany 321.
Mica:			
Crude including splittings and waste	[r]1,580	180	All from France.
Worked	[r]589	1	All from Switzerland.
Pigments mineral: Iron oxides, processed	1,145	1,302	West Germany 1,233; Italy 51.
Precious and semiprecious stones:			
Natural value, thousands	[r]$152	$216	West Germany $121; United States $53.
Synthetic do	$71	$90	All from Switzerland.
Salt	130,177	127,523	U.S.S.R. 118,117; Poland 6,105.
Sodium and potassium compounds, n.e.s.:			
Caustic soda[7]	2,400	300	West Germany 30.
Caustic potash	--	2	All from United Kingdom.
Soda ash[3] thousand tons	161	181	East Germany 65; Romania 53; Bulgaria 40.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	14,366	15,873	Yugoslavia 15,120.
Worked	303	316	Yugoslavia 266; Belgium-Luxembourg 45.
Dolomite	109	198	West Germany 172.
Gravel and crushed rock	6,848	5,532	Hungary 3,531; France 1,540.
Limestone	176	--	
Quartz and quartzite	5,543	6,269	All from West Germany.
Sand, excluding metal-bearing	5,496	5,372	Hungary 5,193.
Sulfur:			
Elemental:			
Other than colloidal[3] thousand tons	456	501	Poland 440; West Germany 43.
Colloidal	147	104	Italy 99.
Sulfuric acid[3]	59,726	83,294	U.S.S.R. 64,019; West Germany 14,312.
Talc	168	178	Norway 93; West Germany 84.
Other:			
Crude	8,172	11,194	Hungary 8,292; West Germany 2,522.
Slag, dross, similar waste	60	--	
Oxides and hydroxides of magnesium, strontium, barium	26	21	All from West Germany.
Halogens	10	4	All from United Kingdom.

See footnotes at end of table.

Table 3.—Czechoslovakia: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	61	50	All from West Germany.
Carbon black[3]	32,639	33,974	U.S.S.R. 17,650; Romania 5,672; Austria 3,193.
Coal, all grades including briquets:			
Anthracite and bituminous[3] thousand tons	5,591	5,492	U.S.S.R. 3,246; Poland 2,246.
Lignite and lignite briquets[3] do.	466	475	East Germany 355.
Coke and semicoke[7] do.	36	--	
Gas, natural[3] million cubic feet	202,952	259,385	All from U.S.S.R.
Petroleum and refinery products:			
Crude[3] thousand 42-gallon barrels	136,530	138,430	U.S.S.R. 136,225.
Refinery products:			
Gasoline[7] do.	1,590	2,312	NA.
Kerosine do.	50	60	West Germany 48; Yugoslavia 9.
Distillate fuel oil[7] do.	4,036	3,297	NA.
Residual fuel oil do.	628	472	West Germany 468.
Lubricants do.	320	[r]127	Yugoslavia 50; West Germany 25.
Other:			
Liquefied petroleum gas do.	80	183	West Germany 102; Austria 80.
Mineral jelly and wax do.	16	12	West Germany 10.
Petroleum coke do.	83	66	All from West Germany.
Bitumen and other residues do.	5	([6])	Do.
Bituminous mixtures do.	1	1	Mainly from Austria.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	602	1,653	West Germany 1,298; Netherlands 321.

[r]Revised. NA Not available.

[1]Owing to the lack of official trade data published by Czechoslovakia, this table should not be taken as a complete presentation of Czechoslovakia's mineral imports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of Czechoslovakia.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Official trade statistics of Czechoslovakia.

[4]Metallgesellschaft AG (Metallstatistik) Frankfurt am Main, West Germany.

[5]United Nations. Quarterly Bulletin of Steel Statistics for Europe. New York.

[6]Less than 1/2 unit.

[7]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

COMMODITY REVIEW

METALS

Antimony.—In 1980, antimony was mined at Dubrava (Central Slovak region) and at Pezinok near Bratislava (West Slovak region). Antimony ores were also investigated at the Krasna Hora deposits in Bohemia. The extraction of antimony ore is expected to be increased at Dubrava and Pezinok after 1985. The recycling of the Pezinok antimony was found to be particularly promising since remarkable quantities of gold and silver could be acquired from the dumps of Pezinok.[9]

Copper.—Production of copper in Czechoslovakia continued its growth during 1980 and total output of refined copper was slightly higher than that of 1979. In 1980, extraction of copper ore was concentrated in the stratiform types of Bohemian deposits—Zlate Hory and Tisova—as well as in the Banska Stiavnica and other deposits in Slovakia. In Zlate Hory reserves of ore are estimated at 3.5 million tons with metal content more than 1%. The deposit also contains lead, zinc, and gold. Copper in tetrahedrite and chalcopyrite were mined in Rudnany and Roznova deposits. Rudnany ores contain siderite-barite-copper-mercury mineralization.

In 1980, imports of copper metals from the U.S.S.R. and Poland supplied the main requirements of Czechoslovakian industry. Consumption of copper in Czechoslovakia increased 8% during the last 10 years (1970-80).[10]

Gold.—The rich deposits of gold in Czechoslovakia have been depleted. The remaining gold deposits located in Central Bohemia and in the Slovak Ore Mountains are of little economic significance; however, after discontinuing for 10 years, the extraction of gold-bearing ore in Slovakia is to continue in the Kremnice area. In 1980, it was decided to develop a new mine near Sturec. It is expected that in 1982 about 10,000 tons of gold-bearing ore will be extracted from this mine and in 1984 about

20,000 tons.

Estimated output of gold from the new deposits is expected to be 50 to 70 kilograms per year. Possibilities of renewing gold extraction were also studied in the Jeseniky Mountains.[11]

The Valcovny Div. of the Skoda Concern of Plzen started building a rolling mill for precious metals, which will be installed in the Safina works at Vestec near Prague. The rolling mill called "Kvarto 200" will be used to roll strips and foils from pure silver, silver and gold alloys, brass, and copper. The whole equipment for the mill weighs 69 tons and deliveries are to be completed in 1982.[12]

Iron and Steel.—In 1980, iron ore was mainly extracted from the Rudnany Mines, located in Slovakia. Domestic production supplies about 5.4% of the country's requirement of iron ore and 79.1% of the ore was imported from the U.S.S.R. The remaining 15.5% was imported from Brazil, Sweden, India, and Algeria.

Under a long-term agreement Czechoslovakia participated in the development of the Soviet Union's iron ore projects to cover increasing iron ore imports. In 1980, steel production slightly increased compared with the 1979 level and was below the originally planned level of 16.3 million tons. Steel production in 1981 is expected to be about 15.7 million tons and production of rolled steel is expected to be about 11.1 million tons. In 1980, about 60% of steel produced in Czechoslovakia came from charges of pig iron and alloys and the remainder from scrap.

In 1980, the modernization of Czechoslovakia's steel industry and further improvements in its structure continued. The new medium section mill at Czechoslovakia's New Klement Gottwald Metallurgical Works in Ostrava began trial operation in December 1980. The plant has a capacity of 900,000 tons per year, and is to reach full capacity in 1981. Czechoslovakia's plans for the steel industry were to reduce the open-hearth production and to increase the oxygen converter output; however, the share of oxygen converter steel output in 1980 was approximately the same as in 1978 (25.9%). The share of steel continuously cast increased from 0.38% in 1978 to 1.49% in 1980. Total investment in the iron and steel industry in 1980 was estimated at Kcs5.4 billion.

Lead and Zinc.—In 1980, lead-zinc ores were mined at Banska Stiavnica (Slovakia) and also at deep levels of mines at Pribram (Central Bohemian region) and Kutna Hora (eastern part of the Central Bohemian region). Ore production was approximately 0.6 million tons. The lead-zinc ore produced at Banska Stiavnica Mines was exported to market economy countries in the form of concentrate with gold and silver content because Czechoslovakia did not have the facility to separate gold, silver, zinc, and lead from each other.[13]

Benefication and metallurgical facilities in Czechoslovakia continued to experience poor metal recovery, particularly from mixed ores. Czechoslovakia is planning development of lead-zinc deposits at Banska Stiavnica-Hodrusa. Reserves of lead and zinc ore in the new recently discovered deposits near Banska Stiavnica are estimated at approximately 50 million tons.

In 1980, Czechoslovakia imported lead and zinc mostly from the U.S.S.R. and Yugoslavia. The development plan anticipated large investigations for a new lead-zinc deposit in the Horny Benesov area (North Moravia).

Mercury.—In 1980, mercury was extracted from vein deposits at Rudnany (Slovakia). New deposits of mercury ore were discovered in the vicinity of Malachov near Banska Bystrica in Slovakia. Plans are to develop new deposits and to extract 20,000 tons of mercury ore at Malachov in 1984.

Tin.—Tin continued to be mined in the Cinavec (North Bohemian region) and at the Horni Slovak (West Bohemian region) in 1980. Tin mining is expected to increase in the future. Plans are to develop new cassiterite deposits discovered in Slovakia near Medvedi Brook in the vicinity of the Hnilec Village. The tin industry experienced domestic raw material shortages. In 1980, tin was mainly imported from the United Kingdom, Bolivia, and India. Consumption of tin in 1980 increased about 20% over that of 1970.[14]

Uranium.—Czechoslovakia has significant uranium ore deposits. Reportedly the Czechoslovakia uranium industry achieved all planned production tasks for 1980.

In the last few years the Czechoslovak uranium industry concentrated its attention on the Hamar area in the Ceska Lipa district (North Bohemian region) and on the Pribram area (Central Bohemian region). A new uranium dressing plant was put into operation in the Ceska Lipa district in 1979. In 1980, further mining and dressing facilities were under development in the Ceska Lipa district. On September 5, 1980, the

concern enterprise "Pribram Uranium Mines" was renamed the "Czechoslovak Soviet Friendship Enterprise." The U.S.S.R. has total control of the exploration and production of uranium in Czechoslovakia.

NONMETALS

Cement.—The new cement plant at Prachovice in Eastern Bohemia, 100 kilometers from Prague, with a capacity of 1.2 million tons of cement per year, went into operation in 1980. Construction of this plant started in 1974 and the cost was estimated at Kcs2.0 billion. Desposits of calcite in this area were estimated to be sufficient for about 50 years. Reportedly, production of cement at the Prachovice plant is automatic and controlled by computer. Fly ash and waste gases are to be retained and processed into fertilizers. The cement at the Prachovice is made by dry technology.

The large-capacity cement plant Zahorie II at Rohoznic (West Slovak region) was also recently completed. Czechoslovakia is expected to remain an importer of cement for the near future. In 1980, cement was imported mostly from the U.S.S.R., Romania, and the German Democratic Republic.

Prerov Machinery of Czechoslovakia, a monopoly producer of cement, brick, and ceramic plants in the country, exports three-quarters of its output through Pragoinvest, a foreign trade organization.

Reportedly in 1980, Prerov Machinery completed a brick plant and a ceramic plant in Iraq, a cement plant with an output of 2,800 tons of clinker per day in Capao Bonito, Brazil, and facilities for cement production in the Amazon River Valley. In 1980, Brazil contracted for construction of three more cement plants.

Fertilizer Materials.—In 1980, Czechoslovakia continued to make an urea-ammonium nitrate solution, DAM-390, at the new plant at Dusla National Enterprise at Sala (West Slovak region) at the rate of an estimated 100,000 tons per year. The output is to reach 600,000 tons in 1987. Nitrogenous fertilizer was also produced at the Lovosice-Zaluzi chemical complex (North Bohemian region) and at the chemical complex at Strazske (East Slovak region).

In 1980, consumption of fertilizer per hectare of agricultural land was 253 kilograms in nutrient content. Czechoslovakia's production of nitrogenous and phosphate fertilizers provided approximately 60% to 70% of the country's consumption. Nitrogenous fertilizer continued to be imported from the U.S.S.R., potassium fertilizers from the German Democratic Republic and the U.S.S.R., and phosphates from the U.S.S.R. and African countries. Czechoslovakian geologists are to undertake an extensive survey of phosphate deposits in southwest Nigeria, in an area only a few kilometers from the Beni border.

Fluorspar.—Production of fluorite is concentrated in the Ore Mountains (North Bohemia). Czechoslovakia has only one mining enterprise for the production of fluorite concentrate, Sobedruhy. The flotation plant at Sobedruhy, near Teplice, produces concentrate with 95% fluorite (CaF_2). Recently discovered fluorspar deposits in the Ore Mountains are to help make Czechoslovakia self-sufficient in fluorite after 1985.

All deposits of fluorites in Czechoslovakia belong to the hydrothermal type. In the Ore Mountains fluorite is associated with barite, quartz, sulfides, and carbonates. Fluorspar deposits of less significance are located in the South Bohemian region. Under an agreement between Czechoslovakia and mainland China, signed in Prague on May 11, 1981, fluorite is to be imported from China.

Kaolin.—In 1980, production of kaolin fully covered the consumption of this raw material in Czechoslovakia and 380,000 tons was exported. Czechoslovakia is the world's fourth producer of kaolin after the United States, British Columbia, Canada, and the U.S.S.R. In 1980, exports of kaolin went mainly to the Federal Republic of Germany, Poland, and Austria. Kaolin deposits occur in the Karlovy Vary area, and near Plzen, Podborany, and Znojmo. All kaolin deposits in Czechoslovakia belong to the weathering type, which are characterized by reduced intensity of kaolinization at depth. The principal deposits are in Karlovy Vary, where the highest quality type of kaolin is processed at Bozicany. The kaolin for the paper industry is processed at Kuznejov.

In 1980, preparations were made for production of bleached kaolin by electromagnetic separation, a new method developed in Czechoslovakia that makes it possible to obtain a higher degree of whiteness.

Magnesite.—Czechoslovakia has substantial magnesite deposits and is an exporter of magnesite. Magnesite production slightly increased in 1980 compared with the 1979 level.

Total exports of magnesite in 1980 were estimated at 380,000 tons. Magnesite was exported to Hungary, Poland, the German Democratic Republic, Romania, and the

Federal Republic of Germany. Magnesite was produced from six deposits in Slovakia. The largest deposit in the Dubrovsky massive is 400 meters thick and covers an area of 3.2 million square meters; the ore contains about 30% to 40% MgO.

The country is making an attempt to increase production capacity of the larger mines and to close the small mines.

Perlite.—Reportedly, during the sixth 5-year plan about 5 million to 8 million tons of high-grade perlite ore was discovered in Jastraba near Kremnica (Slovakia), which is to replace imports of that raw material from Hungary.

MINERAL FUELS

Total energy production derived from fossil fuels and from hydroelectric and nuclear power generation was estimated at 87.2 million tons standard coal equivalent (SCE) in 1980 (1 million tons below that of 1979) with coal, including lignite, supplying 97.4%.

Total consumption of primary energy was 127.2 million tons SCE with coal providing about 67%; oil, 22%; gas, 9.5%; and hydroelectric power, nuclear power and imported electric power, about 0.5% each. The primary energy balance of Czechoslovakia for 1979 and 1980 is shown in table 4.

Table 4.—Czechoslovakia: Total primary energy balance

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (bituminous, brown, lignite) and coke	Crude oil and petroleum products	Natural gas	Hydroelectric power	Nuclear power	Turnover of electric energy
1979:							
Production	r88.2	r86.1	0.2	1.1	0.5	0.3	--
Imports	r45.2	r5.8	r29.1	r9.7	--	--	r0.6
Exports	r7.3	r6.1	r1.1	--	--	--	.1
Apparent consumption	r126.1	r85.8	r28.2	r10.8	.5	.3	r.5
1980:[e]							
Production	87.2	84.9	.1	1.0	.6	.6	--
Imports	46.8	5.9	29.2	11.1	--	--	.6
Exports	6.8	5.9	.8	--	--	--	.1
Apparent consumption	127.2	84.9	28.5	12.1	.6	.6	.5

[e]Estimated. [r]Revised.

[1]One ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are as follows: Hard coal, 1.0; brown coal and lignite, 0.6; crude oil, 1.47; natural gas (per 1,000 cubic meters), 1.33; and hydroelectric and nuclear power (per 1,000 kilowatt-hours), 0.125.

Sources: Statistical Yearbook of Czechoslovakia, Prague, 1980; Statisticke Prehledy (Statistic Summary), Prague. No. 3, 1981, p. 66.

Coal.—Except for the North Bohemian brown coal basin, all coal basins fulfilled their quotas in 1980. The shortfall in production at the North Bohemian lignite region amounted to 1.8 million tons. The situation was caused by the long-term failure to fulfill the target for the removal of overburden.

The bulk of the country's bituminous coal output came from the Ostrava-Karvina Basin. Ostrava-Karvina Fields supplied more than 24 million tons of bituminous coal in 1980. Planned targets for 1980 were met only with extra ordinary efforts, including Saturday and Sunday work shifts. In the seventh 5-year plan period (1981-85) it is expected that bituminous coal production from this area will remain steady at 24.5 million tons per year and account for about 85% to 87% of bituminous coal output. The mines in the Ostrava-Karvina Basin are the only producers of coking coal. They comprise 16 mining enterprises in the Ostrava, Karvina, Frydek-Mistek, and Opava districts.

In 1980, bituminous coal in the Ostrava-Karvina Basin continued to be mined under increasingly more difficult conditions. The Darkov Mine with a projected annual capacity of 5 million tons was under development in the Ostrava-Karvina coal basin in 1980. Coal extraction at this mine is planned to begin in the 1980's.

In the last few years two new bituminous coal deposits were prepared for extraction in Frenstat-West near the southern edge of the Ostrava-Karvina coal basin and Slany in Central Bohemia. Development of the Slany deposits started in 1979 and continued in 1980; coal extraction is planned to

begin in 1996. Discovered bituminous coal reserves at Slany were estimated to contain 150 million tons at 800 to 1,300 meters below ground. In 1980, survey drilling to a depth of 6,000 meters at Jakunka in the Beskydy Mountains in Northern Moravia has revealed a deposit of coal which is a continuation of the Ostrava coalfield.

A new deposit of bituminous coal was discovered near Radnice in the Rokycany district in West Bohemia. The deposit covers an area of about 12 hectares between Radnice and Privetice and reserves are estimated at about 1 million tons. The seams of the new Ovcin mine in this district are between 1 and 5 meters thick.

In the seventh 5-year plan period (1981-85) exploration of bituminous coal deposits is to be concentrated on the Celadne-Krasne area in the Ostrava-Karvina coal basin and in the Mseno Basin near Melnik. The country's bituminous coal reserves are sufficient for the next 50 to 60 years at the present rate of extraction.

Czechoslovakia's brown coal deposits have been mined principally by the opencast method; only 15% are mined underground. Futher increases in output are to be derived exclusively from opencast mines, while underground production is to decline. In 1980, about 74% of brown coal came from the North Bohemian Basin and the remainder came from the Sokolow, Kandlova, and Mody Kamen Basins. The 1980 production target for brown coal was underfullfilled primarily at the Maxim Gorkiy large mine and the Czechoslovak Army Mine. Brown coal and lignite output is planned to reach 99 to 100 million tons in 1985 and 111 million tons in 1990, but there are already serious concerns about the declining calorific value of the coal.

The North Bohemian brown coal basin, the largest in Czechoslavakia, covers an area of 850 square kilometers and contains 6.5 billion tons of coal, of which 4.6 billion tons are recoverable.

In 1980, a large opencast lignite mine was under development at Vrsany near Most. The area is planned to be 6 square kilometers. Development of the mine is to cost about Kcs5 billion. The Vrsany Mine, with 7 million tons per year projected capacity, is scheduled to come into operation in 1982 and is to supply coal to the Pocerdany electric powerplant. A new opencast mine in the Socolov lignite field came into operation in June 1980; the deposits total about 9 million tons. The mine is expected to remain in operation until 1988. The development of a new brown coal mine at Miculcice near Hodonin (South Moravia) continued in 1980. The mine is to reach full production capacity of 5 million tons in 1983.

On September 20, 1980, mining operations started at the first opencast lignite mine in Slovakia, located in Lehota near Novaky. The mine is expected to produce 1.3 million tons of brown coal; about 36,000 tons of brown coal was produced at this mine in 1980.

Czechoslovak Premier L. Strougal reported in late 1978 that capital investment in the energy sector for the 5-year plan (1981-85) is to reach Kcs55 billion, and coal is to represent more than one-third of all investment for fuel and power on an annual basis. However, this proposed figure may go higher owing to rising costs, both domestically and worldwide.

Czechoslovakia's total consumption of bituminous and brown coal listed by consumer groups for 1979, in percent, follows:

Consumption	Bituminous coal	Brown coal
Coke plants	49.0	--
Electric powerplants	21.8	50.1
Steam for heating and industrial use	18.9	23.9
Coal gas plants	--	2.7
Railroads	.4	.2
Households	4.3	8.4
Other	5.6	14.7
Total	100.0	100.0

Source: Statisticka Rocenka Ceskoslovenska Socialisticke Republiky (Statistical Annual of the Czechoslovak Socialistic Republic), Prague, 1980, p. 367.

Natural Gas.—In 1980, a new field of natural gas was put into operation in Czechoslovakia, in Dolni Durajovice, where reserves are estimated at 1.6 million cubic meters; other gas deposits were discovered in the Hodonin, Senice, and Michalove districts. However, the production of natural gas from local deposits was relatively insignificant. The U.S.S.R. supplied all of Czechoslovakia's gas imports in 1980. The transit gas pipeline, whose construction began in the early seventies, reached an annual capacity of 37 billion cubic meters in 1980 and this is to be expanded to 53 billion cubic meters by 1984. Soviet natural gas is carried by the Czechoslovak gas pipeline system to Western Europe (the Federal Republic of Germany, France, Austria, and

Italy) and to the German Democratic Republic and Yugoslavia, while the system also supplies natural gas for Czechoslovakia's own needs.

Czechoslovakia is compensated by the U.S.S.R. with natural gas deliveries for its participation in the building of the gas pipeline and for the transit of the gas across Czechoslovakia territory. In the 1981-85 5-year plan period, the transit gas pipeline is to transport 210 to 230 billion cubic meters of gas, of which 40 billion cubic meters are to be for Czechoslovakia's economy.

The gas generated in Czechoslovakia's own Sokolov brown coal basin near Zaluzi is carried by a 350 to 500 millimeter pipeline to Prague, Brno, and Central Slovakia. From Vresova it is carried to Brno and from Usti nad Labem to Ostrava.

Petroleum.—The Friendship pipeline, which went into operation in 1962, carried 18.8 million tons of crude oil from the U.S.S.R. to Czechoslovakia in 1980. About 0.5 million tons of crude oil was imported from nations of the Organization of Petroleum Exporting Countries (OPEC). Annual deliveries of Soviet oil, which provides most of Czechoslovak needs, are slated to remain at the 1980 level of 18.8 million tons under the trade agreement for exchange of goods between the two countries. Czechoslovakia participated in the construction of the Adria oil pipeline (together with Yugoslavia and Hungary) leading from Rijeka in Yugoslavia over Sisak and the territory of Hungary to the Czechoslovak border at Tupa where it is linked to the Druzba pipeline. The Adria pipeline was put into operation at the end of 1979 and is to be used for crude oil coming from OPEC to Czechoslovakia and other countries. Indigenous crude oil was produced mainly in the southeastern part of the South Mountain region and in the West Slovak region, and was relatively insignificant.

In September 1980, the second petrochemical complex was completed at Litvinov in North Bohemia. The enterprise will soon achieve production capacity of 450,000 tons per year ethylene, 270,000 tons per year propylene, and 170,000 tons per year benzene.

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[1]Foreign mineral specialist, Branch of Foreign Data.
[2]Official exchange rate for Czechoslovakia korunas (Kcs) to U.S. dollars was Kcs5.25=US$1.00 (April 1980).
[3]Rude Pravo. Jan 23, 1981, pp. 1-3.
[4]Statisticka Rocenka Ceskoslovenske Socialisticka Republiky (Statistical Annual of the Czechoslovak Socialist Republic) (Prague). 1980, p. 358.
[5]Pages 361-362 of work cited in footnote 4.
[6]Rude Pravo. Dec. 30, 1980, p. 1.
[7]Zahronicni Obhod, (Foreign Trade) (Prague). No. 10-11, 1980, pp. 13-14.
[8]Czechoslovak Foreign Trade (Prague). No. 4, 1981, p. 46.
[9]Rude Pravo. Aug. 8, 1980, pp. 1-2.
[10]Mlada Fronta (The Youth Front) (Prague). Nov. 15, 1980, p. 3.
[11]Lidova Democracie (People Democraty) (Prague). Dec. 9, 1981, p. 1.
[12]Czechoslovak Foreign Trade (Prague). No. 3, 1981, p. 3.
[13]Work cited in footnote 9.
[14]Work cited in footnote 10.

The Mineral Industry of Denmark and Greenland

By Joseph B. Huvos[1]

Denmark and Greenland have few mineral resources and must import most fuels and minerals. Production includes some crude oil in the North Sea, some industrial minerals in Denmark, and lead and zinc in Greenland.

During 1980, the Denmark and Greenland economy slid into recession, which deepened in the second half of the year. The gross national product (GNP) was down 1% in real terms from the 1979 level. At current prices it was almost $55 billion.[2]

The Government's anti-inflationary program reducing real earnings (by 5%) and halting the growth in public budgets has been pursued with determination. Inflation was 12.3% and unemployment was 6.7%. The contribution of the principal sectors of the mineral industry to the GNP, in million dollars and average employment, are shown in the following tabulation:

Sector	Contribution to GNP (millions)		Average 1979 employment (thousand persons)
	1978	1979	
Iron, steel, base metals	$392	$459	7,827
Nonmetals	1,024	1,110	24,006
Oil refining	819	1,257	589
Fertilizers	116	124	1,336
Total	2,351	2,950	33,758

Source: Danmarks Statistik (Copenhagen). Industrial Statistics 1979. February 1981, pp. 22-23.

DENMARK

Some of the important events in the mineral industry of Denmark and Greenland included successful efforts by the Danish Government to change the allocation and ownership of oil rights, by concluding an agreement for this purpose with A. P. Möller, and efforts by the Det Danske Staalvalsevaerk Co. (DDS) to secure a loan of $100 million for restructuring the company.

Table 1.—Denmark: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
Cement, hydraulic[2] thousand tons	2,355	2,309	2,627	2,412	[e]2,000
Chalk[2]	89,719	124,133	110,939	123,654	[e]120,000
Clays: Kaolin, crude and washed[e]	23,000	23,000	23,000	20,000	20,000
Coke, gashouse	70,000	[e]70,000	NA	NA	NA
Diatomaceous materials:[e]					
Diatomite	21,000	25,000	25,000	25,000	25,000
Moler	[r]230,000	230,000	230,000	180,000	180,000
Iron and steel:					
Iron ore (less than 42% Fe), gross weight thousand tons	8	5	5	9	8
Crude steel[3] do	722	686	863	804	734
Semimanufactures do	552	[4]560	[4]646	[4]683	[4]655
Lead metal including alloys, secondary	[r]14,600	[r]24,200	26,200	29,800	24,500
Lime, agricultural and quicklime[2] thousand tons	231	173	162	177	170
Nitrogen: N content of ammonia	33,000	32,900	32,900	32,900	31,200
Peat, agricultural[2]	39	40	47	45	45
Petroleum:					
Crude thousand 42-gallon barrels	1,492	3,285	3,305	3,313	2,272
Refinery products:					
Gasoline do	11,863	11,943	12,045	12,410	9,367
Jet fuel do	1	72	32		80
Kerosine do	866	775	698	730	202
Distillate fuel oil do	[e]25,081	25,588	24,648	27,740	20,821
Residual fuel oil do	16,242	14,992	16,497	18,980	14,099
Lubricants do	30				--
Other do	3,577	3,839	3,839	4,380	
Refinery fuel and losses do	3,615	4,465	4,465	4,400	6,517
Total do	61,275	61,674	62,224	68,640	51,086
Salt[2] thousand tons	349	314	325	380	[e]380
Sodium compounds: Sodium carbonate[e]	1,000	1,000	1,800	2,754	[e]2,700
Stone, sand and gravel:[2]					
Dimension stone[5] thousand cubic meters	35	39	48	NA	NA
Crushed and broken stone:[6]					
Limestone:					
Agricultural do	1,887	1,687	1,782	2,119	[e]2,100
Other do	278	284	226	213	[e]200
Other do	11	10	11	NA	NA
Sand:					
Industrial do	1,135	1,161	1,694	NA	NA
Other do	786	626	421	881	NA
Sulfur, byproduct	10,000	11,000	14,000	8,000	8,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Oct. 12, 1981.

[2]Data represent sales.

[3]Includes shipyard's production of steel castings.

[4]Excludes steel forgings.

[5]Granite and gneiss only; excludes an unreported quantity of other dimension stone with a sales value of $332,341 in 1976 and $302,838 in 1977 (not available for 1978, 1979, and 1980).

[6]Partial figures; exclude an unreported quantity of quartz and quartzite with a sales value of $377,833 in 1976, and $356,143 in 1977 (not available for 1978, 1979, and 1980).

Table 2.—Denmark: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	41,561	51,989	NA	United Kingdom 24,352; West Germany 15,075.
Oxides and hydroxides	109	270	22	Norway 106; Sweden 78; West Germany 18.
Metal including alloys:				
Unwrought including scrap	17,207	21,528	20	West Germany 15,392; Belgium-Luxembourg 2,340; Sweden 1,572.
Semimanufactures	12,459	15,448	31	Sweden 6,460; West Germany 2,029; Norway 697.

Table 2.—Denmark: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Antimony metal including alloys, all forms	23	3	--	Venezuela 2; Norway 1.
Chromium: Chromite	12	30	--	Belgium-Luxembourg 18; West Germany 12.
Cobalt metal including alloys, all forms kilograms	--	8	--	Mainly to West Germany.
Copper metal including alloys:				
Scrap	12,499	12,735	--	West Germany 12,033; Sweden 348.
Unwrought	882	1,235	NA	Sweden 805; West Germany 151; Norway 145.
Semimanufactures	9,246	10,943	(1)	United Kingdom 1,753; Sweden 1,387; France 1,044.
Gold, waste and sweepings -- value, thousands	$1,680	$3,176	NA	West Germany $1,151; Netherlands $1,026; Switzerland $624.
Iron and steel:				
Ore and concentrate	10,323	6,751	200	Netherlands 2,620; United Kingdom 2,215; West Germany 791.
Roasted pyrite	608	23	--	All to West Germany.
Metal:				
Scrap	81,430	91,176	NA	West Germany 65,411; Sweden 9,710; United Kingdom 7,180.
Pig iron including cast iron	r109	356	--	Sweden 258.
Sponge iron, powder, shot, ferroalloys	118	183	NA	NA.
Steel, primary forms	3,076	26,747	--	Sweden 10,313; West Germany 8,161; Nigeria 4,816.
Semimanufactures:				
Bars, rods, angles, shapes, sections	106,031	138,278	--	West Germany 57,991; Sweden 29,615; United Kingdom 18,833.
Universals, plates, sheets	374,950	426,991	6,372	West Germany 124,218; United Kingdom 89,234; Sweden 86,507.
Hoop and strip	16,428	21,371	--	Sweden 18,855; West Germany 883.
Rails and accessories	7,740	3,615	--	West Germany 2,200; Ireland 1,359.
Wire	5,098	5,561	200	Sweden 2,278; Finland 675.
Tubes, pipes, fittings	41,440	52,864	60	Sweden 30,899; West Germany 7,518; Netherlands 2,660.
Castings and forgings, rough	16,008	18,435	--	Sweden 6,970; West Germany 6,835; Norway 1,813.
Lead:				
Ore and concentrate	580	515	--	All to West Germany.
Oxides	47	55	NA	Saudi Arabia 23; United Kingdon 18; Hong Kong 10.
Metal including alloys:				
Scrap	801	1,322	NA	Mainly to West Germany.
Unwrought	17,962	15,045	714	Sweden 3,906; Norway 3,286; Austria 2,218.
Semimanufactures	430	271	NA	Finland 190; Norway 26; West Germany 24.
Magnesium metal including alloys, all forms	187	167	NA	West Germany 144; Sweden 23.
Manganese oxides	235	270	NA	Mainly to Sweden.
Mercury 76-pound flasks	75	78	NA	United Kingdom 49; West Germany 20.
Molybdenum metal including alloys, all forms	2	1	--	All to West Germany.
Nickel metal including alloys, all forms	75	235	NA	West Germany 164; United Kingdom 21; India 17.
Platinum-group metals including alloys, unwrought and partly wrought thousand troy ounces	1	2	NA	Mainly to Sweden.
Silver:				
Waste and sweepings[2] -- value, thousands	$2,534	$5,633	NA	Switzerland $2,056; United Kingdom $1,400.
Metal including alloys, unwrought and partly wrought thousand troy ounces	884	1,150	NA	Sweden 567; Netherlands 165; Norway 123.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Tin metal including alloys:				
Unwrought	660	1,313	127	United Kingdom 630; Netherlands 138; Norway 127.
Semimanufactures	177	103	3	Norway 53; Sweden 8.
Titanium oxides	177	484	NA	West Germany 176; Belgium-Luxembourg 99; United Kingdom 82.
Tungsten metal including alloys, all forms	10	7	--	Sweden 4; West Germany 3.
Zinc:				
Oxides and hydroxides	27	16	NA	United Arab Emirates 8; Iraq 2; Sudan 2.
Metal including alloys:				
Scrap including blue powder	4,455	3,317	NA	West Germany 2,049; Norway 433; Belgium-Luxembourg 328.
Unwrought and semimanufactures	225	458	NA	China, mainland 144; Sweden 84; Singapore 71.
Other:				
Ores and concentrates	1,320	81	--	West Germany 64; Sweden 17.
Ash and residue containing nonferrous metals	5,166	8,635	--	West Germany 6,057; Norway 1,579.
Oxides, peroxides, hydroxides	9	51	NA	Japan 20; Hong Kong 15.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	3	15	NA	Greenland 4; Sweden 3.
Artificial corundum	2	2	NA	NA.
Grinding and polishing wheels and stones	1,285	847	(1)	Ethiopia 197; Iran 195; Arab Republic of Yemen 103.
Asbestos, crude	268	80	NA	Norway 43; Switzerland 21.
Barite and witherite	690	43	NA	Iceland 15; Republic of Korea 10.
Boron materials: Oxide and acid	25	35	NA	Sweden 33.
Cement	338,651	280,464	NA	Venezuela 90,491; Sweden 66,129; Israel 26,456.
Chalk	17,367	14,729	54	Sweden 7,707; Norway 4,954; Finland 1,090.
Clay and clay products:				
Crude clays	2,217	2,928	NA	Sweden 1,067; West Germany 594; Norway 338.
Products:				
Refractory including nonclay brick	32,119	36,951	1,111	United Kingdom 7,301; West Germany 5,351; Norway 3,261.
Nonrefractory	71,274	79,172	690	West Germany 61,426; Sweden 7,545; Norway 4,596.
Cryolite and chiolite	29,250	27,537	NA	NA.
Diamond: Gem, not set or strung carats	77	371	--	Finland 327; Belgium-Luxembourg 19; Sweden 13.
Diatomite and other infusorial earth	53,115	58,110	71	West Germany 25,663; Netherlands 12,458; Switzerland 6,452.
Feldspar and fluorspar	21	--		
Fertilizer materials:				
Crude:				
Phosphatic	732	124	NA	Mainly to Sweden.
Other	92	337	--	Sweden 275; Norway 42.
Manufactured:				
Nitrogenous	115	400	NA	Faroe Islands 183; West Germany 178.
Phosphatic	25,695	37,978	NA	Nigeria 24,979; United Kingdom 4,909; Gambia 3,488.
Potassic	111	30	NA	Norway 23; Sweden 4.
Other including mixed	24,617	46,884	NA	United Kingdom 15,299; Venezuela 14,650.
Ammonia	466	527	NA	Sweden 439; Faroe Islands 21; Greenland 15.
Graphite, natural	25	48	NA	West Germany 25.
Gypsum and plasters	130	123	NA	Sweden 88; Malaysia 13; Norway 8.

See footnotes at end of table.

Table 2.—Denmark: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Lime	9,368	15,602	NA	West Germany 9,029; Norway 4,805; Sweden 1,563.
Magnesite	89	41	NA	Yugoslavia 22; West Germany 16.
Mica, all forms	65	58	NA	West Germany 17; Switzerland 10.
Pigments, mineral: Processed iron oxides	86	108	NA	Finland 22; Iceland 20; United Arab Emirates 19.
Precious and semiprecious stones, except diamond kilograms	82	2,013	NA	NA.
Salt	67,094	38,211	NA	Sweden 26,080; Norway 7,860.
Sodium and potassium compounds, n.e.s	r1,710	453	NA	Sweden 147; Faroe Islands 77; United Kingdom 75.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	50,396	45,534	NA	Mainly to West Germany.
Worked	5,577	8,806	8	West Germany 5,861; Kuwait 2,313.
Dolomite, chiefly refractory grade	113	97	NA	Iceland 50; United Kingdom 14.
Gravel and crushed rock thousand tons	1,536	1,372	NA	Mainly to West Germany.
Limestone except dimension	81,438	70,246	NA	Sweden 36,171; West Germany 24,099.
Quartz and quartzite	217	689	NA	Sweden 327; Italy 168.
Sand excluding metal-bearing	138,325	408,085	NA	West Germany 250,160; Sweden 140,597.
Sulfur:				
Elemental, all forms	4,467	25	NA	Iceland 20.
Sulfuric acid, oleum	39,137	50,462	NA	Finland 20,988; Netherlands 8,674; Spain 5,910.
Talc, steatite, soapstone, pyrophyllite	72	506	NA	West Germany 380; Hong Kong 29; Sri Lanka 21.
Other:				
Crude	1,125	1,322	NA	Finland 529; West Germany 511; Switzerland 142.
Slag, dross, and similar waste, not metal-bearing	10,947	19,526	NA	Sweden 8,406; France 4,777; West Germany 4,457.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	r4	47	NA	Yugoslavia 25; Sweden 19.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	127	284	NA	Faroe Islands 153; West Germany 63; Sweden 38.
Carbon black and gas carbon	20	34	NA	Sweden 18; Saudi Arabia 3; West Germany 3.
Coal, all grades including coke and briquets	66,236	58,498	NA	Norway 42,087; West Germany 5,936; Sweden 5,701.
Peat including briquets and litter	2,518	2,081	NA	Sweden 704; West Germany 466; Netherlands 328.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	5,037	5,140	--	Sweden 4,634; Netherlands 136.
Kerosine and white spirit do.	60	161	--	Sweden 86; Greenland 61.
Distillate fuel oil do.	8,513	10,727	--	Sweden 5,487; United Kingdom 2,548; Faroe Islands 847.
Residual fuel oil do.	1,287	2,462	53	Sweden 1,434; Netherlands 718.
Lubricants do.	193	194	--	Norway 127.
Mineral jelly and wax do.	5	5	--	Sweden 3.
Liquefied petroleum gas do.	251	96	--	Sweden 63; Spain 14.
Bitumen and other residues do.	834	676	--	Sweden 291; Norway 212; Finland 158.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r8,912	14,532	NA	Norway 7,942; Sweden 2,250; West Germany 2,059.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]May include platinum-group metals.

Table 3.—Denmark: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	10,134	89,385	NA	Malaysia 50,118; Suriname 31,385.
Oxides and hydroxides	4,294	3,164	184	United Kingdom 2,233; West Germany 620.
Metal including alloys:				
Scrap	1,637	1,377	219	Norway 462; West Germany 389; Sweden 295.
Unwrought	17,122	21,110	56	Norway 15,870; United Kingdom 2,415.
Semimanufactures	51,151	62,833	3,393	West Germany 14,244; Norway 10,293; Sweden 8,619.
Antimony metal including alloys, all forms	8	24	5	Turkey 10; Malaysia 5.
Cadmium metal including alloys, all forms	8	8	NA	Mainly from Norway.
Chromium:				
Chromite	144	175	--	All from Finland.
Oxides and hydroxides	147	381	NA	West Germany 283; Italy 81.
Cobalt:				
Oxides and hydroxides	10	10	--	Belgium-Luxembourg 5; Canada 3; United Kingdom 2.
Metal including alloys, all forms	29	26	(1)	Belgium-Luxembourg 20; West Germany 4.
Copper metal including alloys:				
Scrap	1,460	2,909	321	West Germany 1,130; France 442; United Kingdom 411.
Unwrought	5,945	4,093	280	Belgium-Luxembourg 3,079; West Germany 300; Sweden 229.
Semimanufactures	29,686	38,833	79	Sweden 11,795; West Germany 10,175; Belgium-Luxembourg 10,037.
Iron and steel:				
Ore and concentrate	2,715	1,379	--	Mainly from Sweden.
Roasted pyrite	38,452	25,581	--	Mainly from Norway.
Metal:				
Scrap	262,824	284,249	308	United Kingdom 199,542; West Germany 34,625; U.S.S.R. 31,465.
Pig iron including cast iron	22,651	24,469	8	West Germany 7,278; Sweden 4,725; East Germany 4,008.
Ferroalloys	23,195	21,049	NA	Norway 15,971; United Kingdom 2,487; Sweden 1,428.
Steel, primary forms	36,201	34,231	--	U.S.S.R. 10,626; Sweden 8,964; West Germany 5,373.
Semimanufactures:				
Bars, rods, angles, shapes, sections	377,764	373,218	--	West Germany 97,425; Belgium-Luxembourg 62,500; Sweden 57,891.
Universals, plates, sheets	602,180	707,216	1,997	West Germany 246,972; Sweden 97,076; France 59,109.
Hoop and strip	59,393	63,208	46	West Germany 31,444; Sweden 10,053; Belgium-Luxembourg 4,378.
Rails and accessories	11,970	12,263	--	West Germany 5,877; Belgium-Luxembourg 2,791; France 1,936.
Wire	27,605	30,136	63	Belgium-Luxembourg 10,724; West Germany 9,405; Sweden 5,923.
Tubes, pipes, fittings	203,627	217,343	128	West Germany 68,057; United Kingdom 31,177; Austria 23,484.
Castings and forgings, rough	2,158	3,807	--	West Germany 1,114; United Kingdom 999; Sweden 613.
Lead:				
Oxides and hydroxides	786	526	17	West Germany 244; France 124; United Kingdom 54.
Metal including alloys:				
Scrap	21,869	19,012	333	Norway 5,708; United Kingdom 4,084; West Germany 1,752.

See footnotes at end of table.

Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Lead —Continued				
Metal including alloys —Continued				
Unwrought	7,280	8,884	20	Belgium-Luxembourg 3,049; United Kingdom 2,030; West Germany 1,841.
Semimanufactures	2,009	2,413	NA	West Germany 2,308; United Kingdom 65.
Magnesium metal including alloys, all forms	152	173	22	Norway 103; Canada 20.
Manganese:				
Ore and concentrate	1,383	980	NA	Netherlands 797; West Germany 179.
Oxides and hydroxides	2,153	2,056	74	Belgium-Luxembourg 1,232; Greece 641.
Mercury 76-pound flasks	392	406	NA	Netherlands 110; Spain 75; Sweden 49.
Molybdenum metal including alloys, all forms	3	6	NA	West Germany 4; Austria 1.
Nickel:				
Matte	23	30	--	Canada 12; Sweden 10; United Kingdom 8.
Metal including alloys:				
Unwrought including scrap	197	207	1	Finland 137; United Kingdom 40.
Semimanufactures	240	241	5	West Germany 72; United Kingdom 71; Norway 31.
Platinum-group metals including alloys, unwrought and partly wrought thousand troy ounces	34	22	1	Netherlands 8; Switzerland 6; West Germany 5.
Silver:				
Waste and sweepings[2] value, thousands	$128	$954	NA	Sweden $651; Finland $259.
Metal including alloys, unwrought and partly wrought thousand troy ounces	2,673	3,371	2	West Germany 865; United Kingdom 699; Switzerland 630.
Tin metal including alloys:				
Scrap	200	285	72	West Germany 110; Switzerland 72.
Unwrought	348	323	43	Malaysia 70; United Kingdom 59; West Germany 35.
Semimanufactures	84	72	(1)	United Kingdom 25; West Germany 21; Netherlands 14.
Titanium oxides	5,290	6,796	36	Norway 2,132; United Kingdom 1,481; West Germany 953.
Tungsten metal including alloys, all forms	14	14	(1)	Sweden 5; West Germany 5.
Zinc:				
Oxides and hydroxides	2,320	3,057	--	West Germany 1,636; France 350; Norway 332.
Metal including alloys:				
Scrap including blue powder	2,043	1,389	--	Norway 562; Belgium-Luxembourg 548; Sweden 119.
Unwrought	13,614	17,835	1	Finland 6,205; Norway 6,041; United Kingdom 1,948.
Semimanufactures	4,000	4,106	2	France 2,645; West Germany 1,097.
Zirconium ore and concentrate	--	49	--	Netherlands 25; Australia 24.
Other:				
Ores and concentrates	r211	199	NA	Finland 180; France 14.
Ash and residues containing nonferrous metals	8,818	7,614	3,864	United Kingdom 933; Finland 613; West Germany 538.
Oxides, hydroxides, peroxides	620	740	1	West Germany 412; Belgium-Luxembourg 121.
Metals:				
Metalloids	682	786	--	France 593; Norway 107; Sweden 86.
Alkali, alkaline-earth, rare-earth metals	242	274	(1)	Mainly from West Germany.
Pyrophoric alloys	r3	2	NA	Mainly from United Kingdom.
Base metals including alloys, all forms	r52	108	6	Belgium-Luxembourg 51; Sweden 23; West Germany 14.

See footnotes at end of table.

Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	12,501	25,039	29	Iceland 21,094; West Germany 3,357.
Artificial corundum	469	742	20	West Germany 488; Netherlands 156.
Dust and powder of precious and semiprecious stones, kilograms	19	26	5	Switzerland 15; Netherlands 4.
Grinding and polishing wheels and stones	1,222	1,198	9	West Germany 443; Austria 293; Sweden 197.
Asbestos, crude	21,470	26,865	779	Canada 14,083; Cyprus 7,408.
Barite and witherite	5,863	3,950	18	Ireland 2,693; Netherlands 446; West Germany 365.
Boron materials:				
Crude natural borates	r2,943	4,255	2,722	Netherlands 1,025; West Germany 410.
Oxide and acid	263	379	70	France 182; Italy 114.
Cement	19,382	95,342	107	Sweden 37,144; West Germany 35,596; Norway 13,378.
Chalk	8,942	10,869	4	West Germany 6,298; France 2,182; Sweden 2,053.
Clays and clay products:				
Crude clays	42,382	52,358	1,325	United Kingdom 35,179; West Germany 11,266.
Products:				
Refractory including nonclay brick	33,282	34,659	159	West Germany 17,454; Austria 5,277; United Kingdom 5,151.
Nonrefractory	87,909	93,513	--	West Germany 40,244; Italy 36,423.
Cryolite and chiolite	53,300	44,025	--	All from Greenland.
Diamond:				
Gem, not set or strung, carats	5,437	3,717	NA	Belgium-Luxembourg 1,525; Switzerland 625; Israel 600.
Industrial, do	70,000	120,000	10,000	Switzerland 45,000; Belgium-Luxembourg 30,000.
Diatomite and other infusorial earth	4,233	5,447	2,370	Iceland 1,366; Spain 883.
Feldspar, leucite, nepheline, nepheline syenite	8,902	11,786	NA	Norway 10,794; Sweden 870.
Fertilizer materials:				
Crude:				
Nitrogenous	--	5,501	--	All from Chile.
Phosphatic	281,525	264,651	86,433	Morocco 178,134.
Potassic	825	825	--	All from West Germany.
Other including mixed	44	8	NA	Mainly from Sweden.
Manufactured:				
Nitrogenous	108,709	131,673	--	Norway 75,099; West Germany 39,677.
Phosphatic:				
Thomas (basic) slag	51	--	--	
Other	5,712	10,734	--	Tunisia 7,977; Israel 1,661; West Germany 912.
Potassic	219,646	240,418	86,481	East Germany 69,943; Canada 43,250.
Other including mixed	539,128	641,292	(1)	Norway 480,751; West Germany 72,865; Belgium-Luxembourg 63,788.
Ammonia	277,657	326,679	7,150	West Germany 113,571; U.S.S.R. 39,639; Venezuela 39,126.
Fluorspar	4,462	3,970	--	France 3,387; West Germany 421.
Graphite, natural	754	653	32	West Germany 541; China, mainland 39.
Gypsum and plasters	298,036	316,363	NA	Spain 221,512; France 87,230.
Lime	3,438	5,086	NA	West Germany 2,182; Sweden 1,350.
Magnesite	19,046	16,639	78	Austria 7,333; Spain 3,274; Czechoslovakia 3,150.

See footnotes at end of table.

Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica:				
Crude including splittings and waste	255	274	NA	United Kingdom 117; Norway 80; Canada 52.
Worked including agglomerated splittings	50	71	NA	France 42; Belgium-Luxembourg 13.
Pigments, mineral: Processed iron oxides	5,360	5,553	39	West Germany 4,728; Spain 405; Netherlands 224.
Precious and semiprecious stones except diamond kilograms	5,678	2,409	314	West Germany 608; Brazil 508; India 177.
Pyrite	31	1	NA	NA.
Salt	r279,107	366,120	39	West Germany 185,475; Italy 89,186; U.S.S.R. 59,456.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	55,720	71,287	NA	Norway 39,157; West Germany 26,142.
Caustic potash	2,407	2,682	NA	France 1,296; Belgium-Luxembourg 550; Sweden 473.
Soda ash	67,795	64,497	NA	Netherlands 21,675; East Germany 17,057; United Kingdom 9,411.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	4,509	7,059	NA	Norway 4,288; Sweden 2,138.
Slate	9,594	11,657	43	West Germany 5,041; Norway 3,236; Sweden 2,539.
Other	164,665	94,633	NA	Sweden 65,595; Norway 28,510.
Worked, all types	55,307	48,185	18	Portugal 15,976; West Germany 12,172; Sweden 11,232.
Dolomite, chiefly refractory grade	30,472	32,906	NA	Norway 25,196; West Germany 4,637; Sweden 2,266.
Gravel and crushed rock	870,583	870,401	8	Sweden 779,724; Norway 86,813.
Limestone except dimension	205,691	203,761	NA	Sweden 114,275; United Kingdom 50,632; Norway 37,251.
Quartz and quartzite	5,297	14,280	NA	Sweden 12,859; Norway 731; West Germany 534.
Sand excluding metal-bearing	117,158	120,565	NA	Belgium-Luxembourg 101,162; West Germany 10,139.
Sulfur:				
Elemental, all forms	74,146	74,298	NA	West Germany 71,900; Norway 1,917.
Sulfuric acid, oleum	r4,306	4,701	NA	Mainly from West Germany.
Talc, steatite, soapstone, pyrophyllite	10,583	8,775	290	Norway 3,564; Finland 1,935.
Other:				
Crude	51,770	47,477	156	East Germany 28,956; West Germany 8,659.
Slag, dross, and similar waste, not metal-bearing	6,983	4,460	(1)	West Germany 2,413; United Kingdom 1,879.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	990	615	30	Sweden 300; Italy 118; West Germany 94.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4,857	952	269	West Germany 333; Sweden 302.
Carbon black	3,765	3,994	193	West Germany 1,412; United Kingdom 1,033.
Coal, all grades including coke and briquets thousand tons	6,238	7,706	178	Poland 2,982; Republic of South Africa 2,290.
Peat including briquets and litter	23,634	22,978	23	Sweden 16,447; Netherlands 2,879; U.S.S.R. 1,713.

See footnotes at end of table.

Table 3.—Denmark: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	56,650	60,840	--	Iran 5,587; Kuwait 3,361; United Arab Emirates 2,871.
Refinery products:				
Gasoline ---do---	8,551	8,959	1	Netherlands 3,022; Sweden 2,395; United Kingdom 1,043.
Kerosine and jet fuel ---do---	6,671	5,328	--	Netherlands 2,540; France 948; Belgium-Luxembourg 641.
Distillate fuel oil ---do---	30,787	31,377	215	Netherlands 5,942; Belgium-Luxembourg 2,981; Norway 2,482.
Residual fuel oil ---do---	28,098	20,852	--	Netherlands 5,591; Sweden 3,739; Venezuela 1,978.
Lubricants ---do---	1,574	3,783	34	U.S.S.R. 1,889; Sweden 579; United Kingdom 391.
Mineral jelly and wax ---do---	105	121	2	West Germany 78; Hungary 12.
Petroleum coke, bitumen, other residues do---	1,142	1,137	1	Netherlands 546; West Germany 409.
Liquefied petroleum gas ---do---	1,073	1,222	--	United Kingdom 441; West Germany 353; Norway 101.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	18,442	29,162	--	Norway 9,423; Sweden 9,064; Netherlands 3,336.

[r]Revised. NA Not available.
[1]Less than 1/2 unit.
[2]May include platinum-group metals.

Table 4.—Faroe Islands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, semimanufactures	187	185	--	Denmark 82; Sweden 58; Norway 36.
Copper metal including alloys, semimanufactures	72	77	--	Denmark 60; United Kingdom 11.
Iron and steel metal:				
Pig iron, cast iron, powder, shot	32	50	--	Denmark 47; Norway 2.
Steel, primary forms	72	37	--	Mainly from Norway.
Semimanufactures:				
Bars, rods, angles, shapes, sections	1,507	1,640	--	Denmark 1,428; Norway 182; Sweden 23.
Universals, plates, sheets	1,407	697	--	Denmark 431; United Kingdom 121; Norway 87.
Hoop and strip	6	4	--	All from Denmark.
Rails and accessories	4	13	--	Do.
Wire	42	46	--	West Germany 27; Denmark 12.
Tubes, pipes, fittings	539	535	--	Denmark 420; Norway 71; United Kingdom 22.
Castings and forgings, rough	87	4	--	All from Denmark.
Lead metal including alloys:				
Scrap	--	1	--	Do.
Unwrought	26	23	--	Do.
Semimanufactures	13	11	--	Denmark 7; Finland 2; Norway 2.

Table 4.—Faroe Islands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Magnesium metal including alloys, all forms	--	5	--	All from Sweden.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	--	$1	--	All from Denmark.
Silver metal including alloys, unwrought and partly wrought do.	[1]$21	$11	--	Do.
Tin metal including alloys, all forms	1	2	--	Mainly from Denmark.
Titanium oxides and hydroxides	5	2	--	All from Norway.
Zinc metal including alloys:				
Unwrought including blue powder	20	11	--	Norway 10; Denmark 1.
Semimanufactures	8	10	--	Denmark 8; United Kingdom 2.
Other: Base metals including alloys, all forms	--	10	--	Norway 7; Finland 3.
NONMETALS				
Abrasives, n.e.s.:				
Artificial corundum	1	1	--	All from Denmark.
Grinding and polishing wheels and stones	3	2	--	Denmark 1; Norway 1.
Cement	19,785	17,978	--	Denmark 17,950; Norway 28.
Chalk	12	2	--	Belgium-Luxembourg 1; Norway 1.
Clays and clay products:				
Crude clays	22	15	--	Denmark 14; Norway 1.
Products:				
Refractory including nonclay brick	129	7	--	Denmark 6.
Nonrefractory	392	430	--	Denmark 420; West Germany 7; Norway 3.
Diatomite and other infusorial earth	5	9	--	All from Denmark.
Fertilizer materials:				
Manufactured:				
Nitrogenous	[r]369	218	--	Denmark 182; Norway 36.
Phosphatic	5	27	--	All from Denmark.
Other including mixed	[r]580	328	--	Denmark 254; Norway 74.
Ammonia	3	21	--	All from Denmark.
Gypsum and plasters	3	25	--	Denmark 22; Norway 2.
Lime	27	30	--	All from Denmark.
Pigments, mineral: Processed iron oxides	1	1	--	Do.
Salt and brine	20,106	18,101	--	Spain 16,695; West Germany 1,173; Denmark 218.
Sodium and potassium compounds, n.e.s.: Caustic soda	87	62	--	Mainly from Denmark.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	29	103	--	Norway 80; Sweden 13; Denmark 10.
Worked	[r]50	49	--	Denmark 19; West Germany 19; Norway 7.
Dolomite, chiefly refractory grade	--	1	--	All from Denmark.
Gravel and crushed rock	6,960	9,980	--	All from Norway.
Quartz and quartzite	25	--	--	
Sand excluding metal-bearing	143	82	--	All from Denmark.
Sulfur: Sulfuric acid, oleum	17	14	--	Do.
Talc, steatite, soapstone, pyrophyllite	--	5	--	Norway 4.
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	471	823	--	Denmark 822.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	159	--	Denmark 153; Norway 6.
Coal, all grades including coke and briquets	108	116	--	Denmark 62; United Kingdom 54.
Hydrogen, helium, rare gases	92	107	--	Denmark 106; Norway 1.
Peat including briquets and litter	31	48	--	Denmark 28; Sweden 20.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	123	116	--	Denmark 110; United Kingdom 6.
Kerosine and jet fuel do.	17	13	--	All from Denmark.
Distillate fuel oil do.	499	891	--	Denmark 845; United Kingdom 36; Norway 8.
Residual fuel oil do.	280	118	--	All from Denmark.
Lubricants do.	11	11	--	Mainly from Denmark.
Liquefied petroleum gas do.	1	1	--	All from Denmark.
Bituminous mixtures do.	18	4	--	Mainly from United Kingdom.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5	7	--	Mainly from Denmark.

[r]Revised.
[1]Quantity imported in 1978 was 9,677 troy ounces.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—DDS, Denmark's only steelmaker, was reportedly trying to raise about $100 million as part of a 5-year restructuring. The company lost $22 million in 1980, compared with $18 million the year before, and 18 foreign (creditor) banks were asked to write off part of their debts. The Danish Government was expected to contribute the bulk of the money required, and the plan was put before the European Steel Commission for approval. DDS did not foresee any reorganization of production; it felt that its plant was among the most modern in Europe, but prices had not been high enough to achieve profitability.

The production capacity of DDS was about 1.5 million tons of crude steel per year. The company was an all electric steelmaker, using scrap as the only raw material at its Frederiksvaerk plant, located north of Copenhagen, after the company's four open hearth furnaces and blooming mill were phased out in favor of two electric arc furnaces and a new billet casting plant.

Nonmetals.—*Ammonia.*—Domestic production of ammonia at Superfos AS Fredericia plant in Jutland was less than 10,000 tons per year, making the country largely dependent on imports from the Federal Republic of Germany and the Soviet Union. The Danish compound fertilizer manufacturer, Superfos AS, holds a 40% share in the 450,000-ton-per-year (nitrogen) Brunsbüttel ammonia plant, located in the Federal Republic of Germany on the Elbe River estuary, where the Chemische Werke Hüls is the major shareholder. Superfos will eventually take its annual share of ammonia of about 180,000 tons of nitrogen from this source.

Industrial Minerals.—A number of industrial minerals were produced in Denmark in 1980. While sand was dredged in shallow inshore waters and in the North Sea west of Ejsberg, granite, sandstone, and slate were produced on Bornholm Island, from about 14 quarries, where kaolin was also mined for ceramic purposes. The Danish Salt Co. produced salt by solution mining from a salt dome at Hvornum in northeastern Jutland. Moler, a clayey diatomaceous earth, was mined by several companies on Fur and Mors Islands in northern Jutland.

Lime.—In 1980, AS Faxe Kalkbrud of Copenhagen remained the only producer of burnt lime. Faxe Kalkbrud had the capacity to produce up to 125,000 tons per year from its principal operation at Fakse on Zealand Island; the company operated two rotary kilns at this location, and capacity to produce 15,000 tons per year of hydrated lime. At its other operation at Rödvig, a single rotary hearth calcining kiln has a capacity of 60,000 tons per year. At both locations coral limestone is burnt to produce lime with 94% to 94.5% CaO content for mortar, water purification, sewage treatment, and others.

Mineral Fuels.—According to the annual review by the Energy Administration of Denmark, 1980 was the first year after the 1973-74 oil crisis that showed a great reduction in energy consumption. Oil imports were 11% lower and solid fuel imports were 7% lower than foreseen. Total energy consumption decreased 8%.

Coal.—During recent years Denmark has succeeded in increasing the proportion of coal-fired powerplants of the country to 80% of the total by converting oil-fired powerplants to coal. Poland, a major supplier of coal to Denmark, with about 40% of the total in the past, discontinued deliveries in 1980, and like the U.S.S.R., has not committed itself to supplying coal in 1981. The Republic of South Africa, formerly a supplier, was eliminated for political reasons, leaving the United States as a main supplier, with 800,000 tons in 1980 and about 2 million tons in 1981. Australia, the United Kingdom, and mainland China are the remaining suppliers.

Petroleum and Natural Gas.—In December, the Danish Government announced that it will nationalize all or part of the North Sea interests of the shipping company, Möller, holder of a 50-year concession for Denmark's offshore oil and gas granted in 1962 and operated through the Dansk Undergrunds Consortium (DUC) comprising Möller, Shell Oil Co., Chevron Oil Co., and Texaco Oil Co. The move followed a breakdown of negotiations initiated by the Government in 1980, through which it sought to increase the state tax receipts from oil production and to win back all unexplored acreage for relicensing on tougher terms. Legislation was to be put before the Folketing (Parliament) in 1981. Previously Möller had resisted the demand of the Government that it should relinquish 50% of its unex-

plored territory in 1982 and the remainder in 1985, and had made a counter offer of its own. Finally, Möller has reached an agreement with the Government over the relinquishment of exclusive rights to the Danish offshore, thus averting scheduled legislation to expropriate most of the territory, probably with an ensuing battle over compensation. The Government intended to offer most of Möller's former concessions for preliminary seismic work in 1981, with exploration licenses being granted from 1983 onward, although Möller won some concessions. Möller also offered to boost its exploration program, envisaging the use of five rigs from 1982 to the end of 1984.

Möller is to be allowed to retain all of its existing finds, together with an area comprising eight or nine blocs in the southwestern concession, about 1,200 square kilometers of Denmark's most promising acreage. Tougher financial terms are to apply to the retained acreage, with relinquishment beginning in 2000. Of the acreage Möller is not able to retain, 50% is to be relinquished in 1982, a further 25% in 1984, and the remainder in 1986. Möller had to agree to send the state's share of its oil production ashore through a Government-owned pipeline, for which a 5% transit fee will be payable, and has conceded to the state's Dansk Olie og Naturgas AS the right to buy 40% of all Möller-produced oil.

Crude oil production continued at a very modest pace from the North Sea Shelf at the Dan Field, Denmark's first, about 200 kilometers west of Ejsberg. Output in 1980 was about 298,000 tons. Gorm, Denmark's second oilfield, came onstream in May 1981, at a rate of about 800,000 tons per year and was scheduled to increase in 1982 to 2 million tons per year. Reserves were estimated at 15 to 20 million tons. An additional five wells are to be brought into production at the Gorm wellhead platform A. A second wellhead, platform B, was being drilled.

Two further projects, the Tyra and Roar Gasfields were to be developed, with processing facilities to be sited in the Gorm Field. A pipeline was to be laid from Gorm to a landfall in Jutland. DUC has applied for permission to develop its Skjöld Field beginning in 1982. The field is located between the Dan and Gorm Fields.

Denmark's oil refining capacity remained unchanged at about 12 million tons per year. Gulf Refining Co., Dansk Esso AS, and AS Dansk Shell had refineries at Stignaes and Kalundborg, both on Zealand Island and at Fredericia in Jutland, in that order.

GREENLAND

PRODUCTION AND TRADE

Greenland's mineral production for 1976 through 1980 is shown in table 5. Greenland's foreign trade for 1978 and 1979 are detailed in tables 6 and 7.

Table 5.—Greenland: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
Lead, mine output, metal content	27,000	28,800	30,600	31,900	30,100
Silver, mine output, metal content thousand troy ounces	479	521	559	765	547
Zinc, mine output, metal content	81,000	76,600	82,400	87,300	92,100

[p]Preliminary.

[1]Table includes data available through Oct. 12, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) are undoubtedly produced, but output is not reported and available information is inadequate to make reliable estimates of output levels. Also, chromite apparently was produced in 1979 for metallurgical purposes.

Table 6.—Greenland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
Chromium: Chromite	--	4,800	--	All to France.
Copper metal including alloys, scrap	82	23	--	All to Denmark.
Cryolite and chiolite	53,302	44,048	--	Denmark 44,025; Italy 23.
Iron and steel metal, scrap	--	51	--	All to Denmark.
Lead ore and concentrate	43,205	45,558	--	France 20,957; West Germany 13,073; Brazil 11,528.
Precious and semiprecious stones except diamond kilograms	2,800	NA	NA	NA.
Stone, sand and gravel: Dimension stone, worked	2	2	--	All to Denmark.
Zinc ore and concentrate	138,737	115,511	--	Finland 59,287; West Germany 29,276; France 15,248.

NA Not available.

Table 7.—Greenland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	42	82	(1)	Denmark 78; United Kingdom 3.
Copper metal including alloys, semimanufactures	46	62	--	All from Denmark.
Iron and steel metal:				
Pig iron, cast iron, powder, shot	--	25	--	Do.
Steel, primary forms	6	3	--	Do.
Semimanufactures:				
Bars, rods, angles, shapes, sections	2,112	2,618	--	Denmark 2,311; Sweden 254; Canada 42.
Universals, plates, sheets	493	544	2	Denmark 462; Sweden 52; Norway 28.
Hoop and strip	6	8	--	All from Denmark.
Rails and accessories	5	5	--	Do.
Wire	13	14	--	Do.
Tubes, pipes, fittings	808	1,009	14	Denmark 922; Sweden 64; Canada .
Castings and forgings, rough	454	576	--	Bulgaria 476; Sweden 63; Norway 25.
Lead metal including alloys:				
Scrap	--	6	--	All from Denmark.
Unwrought and semimanufactures	20	10	--	Do.
Nickel metal including alloys, all forms	2	--		
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$3	$1	--	Do.
Silver metal including alloys, unwrought and partly wrought do	$6	$10	--	Do.
Tin metal including alloys, semimanufactures	5	(2)	--	Do.
Zinc metal including alloys, semimanufactures	10	22	--	Do.
NONMETALS				
Boron materials: Crude natural borates	45	NA	NA	NA.
Cement	6,678	9,949	--	Denmark 9,948.
Clays and clay products:				
Crude clays	26	10	--	All from Denmark.
Products:				
Refractory including nonclay brick	32	3	(1)	Mainly from Denmark.
Nonrefractory	314	464	--	Denmark 426; West Germany 30; Netherlands 8.
Diatomite and other infusorial earth	r1	4	--	All from Denmark.
Fertilizer materials:				
Manufactured:				
Nitrogenous	201	727	--	Canada 640; United Kingdom 75; Denmark 12.
Other including mixed	r73	102	--	All from Denmark.
Ammonia	7	15	--	Do.
Lime	20	23	--	Do.
Magnesite	1	--		

See footnotes at end of table.

Table 7.—Greenland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Pigments, mineral: Processed iron oxides	--	2	--	All from Denmark.
Salt	5,015	8,513	--	Spain 7,047; Denmark 1,439.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	2	2	--	All from Denmark.
Caustic potash	--	1	--	Do.
Soda ash	3	3	--	Do.
Stone, sand and gravel:				
Gravel and crushed rock	1,620	4	--	Do.
Quartz and quartzite	--	5	--	All from West Germany.
Sand excluding metal-bearing	65	65	--	All from Denmark.
Sulfur: Sulfuric acid, oleum	21	8	--	Do.
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	981	1,409	--	Do.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	6	--	Do.
Coal, all grades including coke and briquets	r2,680	2,797	--	Do.
Hydrogen, helium, rare gases	54	57	3	Denmark 54.
Petroleum refinery products:				
Gasoline, thousand 42-gallon barrels	r38	69	--	Denmark 53.
Kerosine and jet fuel, do.	r53	100	--	Denmark 61; Netherlands 25.
Distillate fuel oil, do.	r843	1,205	--	Denmark 637; Netherlands 340.
Lubricants, do.	r9	11	--	Mainly from Denmark.
Liquefied petroleum gas, do.	r2	2	--	All from Denmark.
Bituminous mixtures, do.	r7	6	--	Denmark 3.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Unreported quantity valued at $3,000.

COMMODITY REVIEW

Coal.—The Geological Survey of Greenland, under contract with the Danish Energy Ministry, carried out a minor drilling program on the Nugssuaq Peninsula near Jakobshavn and identified a series of exploitable seams of Cretaceous coal. Prefeasibility studies and treatment tests were in progress.

Cryolite.—Raw cryolite stockpiles at Ivigtut, south Greenland, were the basis for a refining operation run by AS Kryolitselskabet Øresund at Copenhagen, Denmark, which exported 20,705 tons of refined cryolite in 1980.

Lead and Zinc.—In 1980, mine production of lead-zinc ore at the Black Angel Mine, located at Marmorilik, west Greenland, was 648,000 tons, containing 13.4% zinc, 5.3% lead, and 37 grams of silver per ton. The mine, Greenland's only lead-zinc mine, was operated by Greenex AS, a subsidiary of Cominco Ltd. of Canada. Concentrates produced included 152,000 tons of zinc concentrate and 42,000 tons of lead concentrate, both exported to various Western European smelters, except for part of the zinc concentrate that was tolled on contract and then sold as zinc metal.

About $2 million was spent in 1980 on exploring for new ores, maintaining reserves at 3.2 million tons. Costs of exploration have risen during the last 6 years because of the need to explore further and the increased thickness of the inland ice. Environmental aspects of mining at Marmorilik received much attention. In 1980, a new tailings system was installed; tailings had already been chemically treated since 1977.

Petroleum.—The Geological Survey of Greenland carried out a series of seismic and magnetic surveys in East Greenland waters, under a contract with the European Economic Community and the Danish Energy Ministry. In 1981, negotiations are planned for oil exploration in Jameson Land by the concessionary, Nordisk Mineselskab, in cooperation with Arco Greenland.

Uranium.—In 1980, about 4,200 tons of uranium ore was mined for experimental purposes at Kvanefjeld near Narassaq, South Greenland. The ore was shipped for leaching to the Danish atomic energy research establishment at Risö, west of Copenhagen. Further field activities for development of the low-grade uranium ore deposits

in South Greenland were hampered by environmental concerns among the Greenland population, whose main source of income was fishing in coastal waters.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Danish kroner (DKr) to U.S. dollars at the rate of DKr6.25=US$1.00.

The Mineral Industry of Egypt

By Peter J. Clarke[1]

Increased petroleum production continued to drive Egypt's economy, providing an estimated real growth rate in the gross domestic product (GDP) of between 8% and 9%. The major mineral industries, besides petroleum, were fertilizer production, phosphate, iron and steel, and aluminum. Revenues from the petroleum sector increased from $1.8 billion[2] in 1979 to an estimated $2.9 billion in 1980, accounting for over 12% of the total gross national product (GNP) of $23.4 billion. These increased revenues from petroleum helped to offset Egypt's import bill, which increased 16% over the 1979 level. Increased revenues from tourism, the Suez Canal, and worker remittances also aided in substantially reducing Egypt's current account deficit, and with higher net capital inflows, Egypt registered a considerable balance-of-payments surplus.

Despite strong growth in the economy overall, several internal problems remained. The population was increasing nearly 3% per year, and unemployment remained high. The public sector accounted for around 70% of total industrial production (nonoil) and operated inefficiently. The Government continued the expensive subsidy system for basic commodities to protect lower income groups from Egypt's high rate of price inflation, which ran at over 20% during the year. This subsidy system has caused persistent budgetary deficits over recent years.

As part of the peace treaty concluded in 1979 between Egypt and Israel, a large portion of the Sinai Peninsula was returned to Egyptian sovereignty during 1980. In April, much of this area was opened up for oil exploration and several concession agreements were signed with companies such as Continental Oil Co. (Conoco), British Petroleum (BP), Ente Nazionale Idrocarburi (ENI), and Compagnie Francaise des Petrole (CFP)-Total. The Sinai was also considered to be a potential source of manganese, coal, kaolin, and gypsum, and studies were initiated by the Egyptian Geological Survey Organization to investigate opening or reopening mining operations in these areas.

The first phase of deepening and widening of the Suez Canal was completed in 1980, enabling ships of up to 150,000 tons, laden, to transit the canal. The second stage was to allow the passage of ships of up to 260,000 tons, laden, and was to be completed by 1985. Revenues from the Suez Canal increased 20% in 1980, to $710 million. Annual revenues are expected to reach $1 billion when the expansion programs are completed.

Egypt continued to negotiate for the supply of two nuclear power stations in their long-term plan for the use of nuclear energy for peaceful purposes. A nuclear cooperation protocol was signed between Egypt and France for the supply of two nuclear power stations, worth over $2 billion. The two reactors were to be 1,000-megawatt pressurized water reactors built by Framatome (France) under license from Westinghouse Corp. (United States). The protocol also included the supply of nuclear fuel. Egypt was scheduled to sign the nuclear nonproliferation treaty in March 1981 to clear the way for the purchase of the reactors.

Egypt also continued investigating the feasibility of constructing a hydroelectric generating plant at the Qattara depression using water from the Mediterranean Sea. The project entailed digging a 76-kilometers channel from the Mediterranean Sea to the Qattara depression, whose base is 135 meters below sea level, and using the flow of water to generate electricity at the rim of

the depression. Lahmeyer International (Federal Republic of Germany) conducted the initial feasibility studies, which were tentatively rejected because of their method of excavation—nuclear explosives. The Swedish Consulting Group began studying the project in late 1980. Pending results of the study, construction was scheduled for as early as the spring of 1981.

Law 43 continued to have a substantial impact on Egypt's economy. Since 1974, when the "Open Door" policy towards foreign private investment first went into effect, the private sector's share in gross fixed investment has risen from 10% to 16%. Oil companies have been the major benefactors, operating production-sharing ventures on favorable terms, but law 43 has also stimulated the private sector in Egypt. Private foreign exchange earnings now finance nearly one-fifth of Egypt's total imports, and their share in the market continues to grow. New emphasis was also placed on decentralizing public sector enterprises in the 1980's in an attempt to streamline their efficiency.

Egypt's 1980-84 5-Year Development Plan was announced in 1980. Public sector investment priorities over the plan period emphasized infrastructure improvements, housing, and food production. The plan would require high import levels for industrial raw materials, equipment, and machinery.

The Government of Egypt, with the financial assistance of the U.S. Agency for International Development (AID), undertook a $37 million petroleum and ground water assessment program to improve their data on mineral and petroleum resources, as well as ground water necessary for the development of such resources. The project was to include new areas of potential mineral and petroleum resources and possibly an atlas of Landsat imagery of the entire country. The program was scheduled for completion in 1983.

PRODUCTION AND TRADE

Production of most of Egypt's mineral commodities increased in 1980, led by new capacity in the petroleum, fertilizer, iron and steel, and phosphate industries. Petroleum production averaged about 590,000 barrels per day in 1980, nearly 20% greater than that of 1979, and export revenues reached $2.9 billion. Egypt planned to produce 1 million barrels of crude oil per day by 1983. Several new discoveries were made during the year, and 36 new exploration concessions were granted.

Egypt became the largest nitrogenous fertilizer producer in the Arab world when the Talkha II fertilizer plant came onstream late in 1980. Annual production of nitrogenous fertilizer was expected to reach 1.7 million tons when Talkha II operates near capacity in 1981. Phosphate production also increased steadily, mainly from the Hamrawein and West Sabaya deposits. Production in 1980 was 20% above 1979 levels. Phosphate rock was used in Egypt's three single superphosphate fertilizer plants and new capacity was being studied to supply a triple superphosphate and phosphoric acid plant at Abu Zaabal.

Iron ore production from the Bahariya Oasis deposits continued to increase in 1980. Steel production also increased from the Helwan iron and steel complex, as the plant switched to higher grade Bahariya ore and natural gas-fired furnaces. The Egyptian Government continued to place high priority on developing the mineral resources of the country. Mineral production in Egypt is shown in table 1.

Egypt's balance-of-trade deficit of $4 billion in 1979 did not improve in 1980, despite the higher level of exports of oil and cotton. The level of imports increased in line with the higher exports. Egypt's principal mineral exports were petroleum, phosphate rock, aluminum, iron and steel, and salt. Petroleum was exported to Italy (70%), Greece (11%), the United States (7%), France (3%), Yugoslavia (2%), Belgium, the Federal Republic of Germany, Sudan, the People's Democratic Republic of Yemen, and Switzerland (the remaining 7%). Egypt exported most of its mineral and nonmineral commodities to Western European and Middle Eastern countries, but the United States remained its largest single trading partner, supplying $1.8 billion worth of goods, or nearly one-fifth of the total imports in 1980, and received about one-seventh of its exports. The United States also remained the largest single aid donor to Egypt, averaging around $1 billion per year over the last 6 years. Official aid for 1980 was in the area of $1.2 billion.

No detailed statistics on Egyptian foreign trade are available for years following 1977; these data appeared in the 1978-79 edition of Minerals Yearbook, Volume III.

Table 1.—Egypt: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal	59,000	89,182	100,698	77,204	120,000
Chromite	243	500	873	22	--
Iron and steel:					
Iron ore and concentrate thousand tons	1,243	1,409	1,456	1,435	[2]1,776
Pig iron do	250	250	[e]300	186	119
Ferroalloys (ferrosilicon) do	5	5	[e]5	--	--
Crude steel do	457	263	[e]600	[e]635	760
Semimanufactures do	706	621	1,000	[e]1,000	[2]847
Manganese ore and concentrate	4,256	3,833	173	--	--
NONMETALS					
Asbestos	1,096	478	349	[e]350	[2]316
Barite	288	746	989	2,272	[2]4,532
Cement, hydraulic thousand tons	3,362	3,257	3,000	2,957	[2]3,028
Clays:					
Bentonite	4,233	3,811	3,448	3,500	3,500
Fire clay	170,052	143,648	383,389	250,000	250,000
Kaolin	28,267	49,000	55,577	46,544	[2]41,227
Diatomite	327	373	99	3,085	3,000
Feldspar, crude	2,128	2,633	3,337	3,271	[2]3,309
Fluorspar	1,557	1,404	2,235	682	[2]1,752
Gypsum and anhydrite, crude	466,604	508,635	798,000	796,000	800,000
Lime	90,000	100,000	100,000	88,000	[2]87,907
Mica	[e]10	86	[e]86	--	--
Nitrogen: N content of ammonia thousand tons	[e]210	210	250	263	400
Phosphate:					
Phosphate rock do	394	472	639	623	700
Thomas slag do	523	NA	NA	9	10
Pigments, mineral, natural: Iron oxide	3,257	32	245	140	135
Pumice[e]	250	250	300	300	350
Salt, marine thousand tons	480	597	755	616	[2]636
Sodium compounds:					
Sodium carbonate	NA	NA	4,000	[e]5,000	[2]4,675
Sodium sulfate	4,000	5,000	2,902	2,902	[2]2,942
Stone, sand and gravel:					
Basalt thousand cubic meters	243	213	281	85	100
Dolomite thousand tons	120	92	130	504	500
Granite, dimension cubic meters	NA	NA	NA	2,666	3,000
Gravel thousand cubic meters	1,500	1,900	2,090	[e]3,300	3,300
Limestone and other calcareous n.e.s do	5,400	5,500	5,667	5,845	6,000
Marble blocks (including alabaster) cubic meters	NA	11,000	25,718	26,000	26,000
Quartz	8,103	9,332	11,348	[e]10,000	10,000
Sand, including glass sand thousand cubic meters	3,535	2,973	2,996	6,147	6,000
Sandstone do	120	120	111	787	800
Sulfur:					
Elemental, byproduct	5,000	[e]5,000	3,106	3,206	3,300
Sulfuric acid	31,000	NA	NA	3,200	32,000
Talc, soapstone, steatite, pyrophyllite	5,636	6,993	5,905	4,406	[2]4,007
MINERAL FUELS AND RELATED MATERIALS					
Coke:					
Oven and beehive thousand tons	[e]650	694	700	853	850
Gashouse and other low temperature do	29	[e]30	[e]40	[e]50	50
Total do	[r]679	724	740	903	900
Gas, natural:					
Gross production million cubic feet	[e]65,000	[e]93,000	[e]105,800	[e]140,000	[2]84,624
Marketed do	13,432	18,670	30,835	120,000	60,000
Petroleum:					
Crude thousand 42-gallon barrels	120,180	150,925	175,925	180,000	[2]215,028
Refinery products:					
Gasoline and naphtha do	12,521	6,936	8,109	8,840	9,000
Kerosine and jet fuel do	11,196	11,671	12,849	12,710	13,000
Distillate fuel oil do	12,809	14,629	16,412	17,205	18,000
Residual fuel oil do	33,673	32,265	36,210	52,281	55,000
Lubricants do	--	336	434	461	500
Other:					
Liquefied petroleum gas do	--	846		1,150	1,200
Asphalt do	818	--	6,115	1,127	1,200
Unspecified do	--	6,542		--	--
Refinery fuel and losses do	4,279	3,976	2,631	4,242	4,400
Total do	75,296	77,201	82,760	98,016	102,300

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through June 23, 1981.
[2]Reported figure.

COMMODITY REVIEW

METALS

Aluminum.—Aluminum production capacity from the State-owned Aluminum Co. of Egypt was scheduled to increase from 133,000 tons per year to 166,000 tons per year when two new potlines come onstream early in 1981. The plant, located at Nag Hammadi, 500 kilometers south of Cairo, produced aluminum ingots, billets, slabs, and rods from eight operating potlines. Alumina was imported from Australia through the Red Sea Port of Safaga, and trucked to Nag Hammadi on the west bank of the Nile River.

Approximately 70% of the output from Nag Hammadi was exported, mainly to Western Europe and Japan. The Port of Safaga was the export terminal for shipments to Japan, and Nag Hammadi and Alexandria were used for exports to Europe.

Aluminum pellets from Nag Hammadi were used in the aluminum extrusion plant at Ismailia, which began production in 1977. Plans also continued for construction of a joint venture aluminum and zinc smelting operation. The State-owned General Co. for Metals and Krupp A.G. (Federal Republic of Germany) planned to produce 24,000 tons per year of zinc plates and strips, and rolled aluminum. The venture was capitalized at $37 million.

Copper.—The Egyptian Geological Survey Organization continued its investigation into copper deposits in the Eastern Desert. Deposits at Um Samiuki contained reserves of 150,000 tons of ore containing 1% to 1.15% copper, 15.2% zinc, 1.1% lead, and 50 grams per ton of silver. Copper-nickel deposits at Gebel Homs and El Ghariba also contained an estimated 70,000 tons of 0.95% copper ore. No decision had been made to work any of the deposits.

Iron and Steel.—Production of iron ore continued to increase in 1980 to approximately 1.5 million tons, as mining operations expanded at the Bahariya Oasis deposits, 500 kilometers southwest of Helwan. Iron ore at Bahariya Oasis occurs in four localities: Gharabi, El Horra, Nasser, and El Gedida. Mining operations were limited to El Gedida, however, where reserves were estimated at 129 million tons, averaging 54% iron. Total reserves at all the deposits were in excess of 250 million tons, and when brought into production, total output was expected to be 3.5 million tons per year. Smaller amounts of iron ore were also mined at Aswan, but operations were being phased out because of the low grade and high silica content of the ore.

Iron ore from the open pit operations of El Gedida was shipped by rail to the State-owned Egyptian Iron and Steel Co.'s steelworks at Helwan. After opening a fourth blast furnace in 1979 and equipping the older furnaces for sintered feed from Bahariya instead of lumpy ore from Aswan, steel output was expected to reach 1 million tons per year in the mid-1980's. Natural gas from the Abu Gharadig Field was used to fuel the new furnaces, reducing the consumption of coking coal previously imported from Poland and the Soviet Union.

Facilities at Helwan included an 80,000-ton-per-year heavy section mill, an 80,000-ton-per-year merchant bar mill, a 110,000-ton-per-year hot strip mill, and a 300,000-ton-per-year cold reduction mill. Nearly 90% of Helwan's production was sold domestically under the "Hadisold" brand, but Egypt remained a net importer of steel. Around 70,000 tons of steel was exported to other countries in the Middle East, and no change in sales patterns were envisioned by the company.

Three other steelmaking facilities also operated in Egypt, all of which produced reinforcing rods for the domestic market. The 110,000-ton-per-year Copper Works was located in Alexandria, and the 250,000-ton-per-year Abu Zaabal works was located in Abu Zaabal. National Metal Industries Co., in Cairo, expanded operations late in 1979, from 80,000 tons per year to 125,000 tons per year with the addition of an open-hearth furnace from Poland and a rolling mill from the German Democratic Republic.

A joint venture company was set up in October 1980 to build a $520 million steelworks at El Dekheila, near Alexandria. The direct reduction plant had a planned capacity of 800,000 tons per year, and was scheduled to begin production in 1984. The company was to be owned 86% by the Egyptian Government; 10% by a Japanese consortium including Nippon Kokan (NKK), Kobe Steel, and Tomen Co. Ltd.; and 4% by the International Finance Corp. (IFC). Financing was to be provided by the Japanese Government ($80 million loan), the World Bank ($100 million loan), and the IFC ($50 million loan).

In June 1980, Egypt and Romania signed a protocol for cooperation on the construction of two plants, one for cement and the other for steel reinforcing bars. The rebar plant was to have an annual production

capacity of 400,000 tons, at a cost of around $100 million.

Manganese.—Manganese production from the Wadi Mesalik deposits located in the Eastern Desert near the Sudanese border ceased in 1979, due to the high cost of transporting relatively small amounts of ore. Feasibility studies were being conducted on reopening the manganese mines at Abu Zeneima on the Sinai Peninsula, which were closed after the 6-day war in 1967. Reserves at Abu Zeneima were estimated at 2 million tons of 21% manganese ore. Kaiser Engineering and Contractors Inc. (United States) was awarded the contract for the study by the Sinai Manganese Co. of Egypt. The study was also to investigate the technical and economic feasibility of reopening the 10,000-ton-per-year ferromanganese smelter at Abu Zeneima, which also operated prior to 1967. Pending the results from Kaiser, the Egyptians planned to invest $100 million in rebuilding the facility.

Uranium.—Egypt's first uranium mine opened in January 1980. The mine was located in the Muskat area of the Eastern Desert. Two other mines, in the same area, were scheduled to open in 1981. Production from the mine was between 30 and 50 tons of U_3O_8 for 1980. The Eastern Desert mines were part of a 5-year research project which is to conclude in 1984, when production is scheduled to reach 100 tons per year.

Analysis of the black sands along the Mediterranean coast continued in 1980. Monzonite from the sands was shown to contain 5.2% thorium and 0.38% uranium. The phosphate deposits at Abu Tartur were also estimated to contain 100,000 tons of uranium.

NONMETALS

Clays.—Kaolin production from the Kalabsha deposits, 105 kilometers southwest of Aswan, registered a slight increase in 1980. Reserves were estimated at 16 million tons of kaolin with a 38% alumina content. The Geological Survey Organization continued its evaluation of the Kalabsha deposit, and also deposits of nepheline syenite in the Abou Khroug area of the Eastern Desert, for possible use in the production of aluminum. New deposits of unspecified clays were discovered in the Nile Valley, south of Suez, and in the Western Sinai. Kaolin deposits in the Sinai Peninsula had been mined at the rate of 30,000 tons per year in 1966-67 but had ceased after the war. Studies were in progress concerning resuming mining operations there.

Fertilizer Materials.—Egypt's production capacity for nitrogenous fertilizer was expected to reach 1.7 million tons per year when the Talkha II ammonia-urea complex came online at the end of 1980. Egypt's nitrogen industry became the largest in Africa and the Arab world. Capacity for production of phosphatic fertilizers was also undergoing expansion, through the addition of a triple superphosphate plant at the Abu Zaabal fertilizer complex. Total phosphatic fertilizer capacity was expected to reach 685,000 tons per year by 1981, when Abu Zaabal was scheduled to come onstream. Additional capacity was expected to make Egypt self-sufficient in fertilizer production, and also provide limited export revenues. Egypt's operating and planned fertilizer plants are listed in the following tabulation.

Location	Operating company	Primary product	Start-up date	Capacity (thousand tons per year)
Suez	Société el Nasr d' Engrais et d' Industries Chimiques.	Calcium nitrate.	1951	275
Talkha I	do	Calcium ammonium nitrate.	1975	365
Talkha II	do	Ammonia-urea	1980	1,000
Abu Qir	do	do	1979	900
Do	do	Ammonium nitrate.	1984	50
Helwan	El Nasr Co. for Manufacturing Coke and Chemicals.	Calcium ammonium nitrate.	1964	140
Kafr-el-Zaiyat	Société Financiere et Industrielle d' Egypte S.A.	Single superphosphate.	1937	200
Assiut	do	do	1969	200
Kosseir	Kosseir Phosphate Co	do	1958	50
Abu Zaabal	Abu Zaabal Fertilizer and Chemical Co.	do	1948	200
Do	do	Triple superphosphate.	1981	175
Do	do	Phosphoric acid	1981	200

The new nitrogenous fertilizer facilities at Talkha were built by Foster Wheeler Italiana utilizing synthesis loop technology in the ammonia plant, and Stamicarbon's process in the urea plant. Natural gas feedstock was piped from the Abu Madi Field in the Nile Delta, which produced around 30 million cubic feet per day. Plans were to increase natural gas production to over 100 million cubic feet per day to support further industrial development. Talkha II had a daily production capacity of 1,200 tons of ammonia, 1,700 tons of urea, and 180 tons of ammonium nitrate.

The Abu Qir fertilizer complex, completed in 1979, also embarked on a program to expand its nitrogenous fertilizer production. The company planned to install a 150,000-ton-per-year fertilizer-grade ammonium nitrate plant to absorb excess ammonia, and a 135,000-ton-per-year nitric acid facility by 1983 or 1984. The Abu Qir plant currently operates a 1,000-ton-per-day ammonia unit and a 1,500-ton-per-day urea plant, both built by Uhde-Mannesmann of the Federal Republic of Germany.

Three phosphatic fertilizer plants in Egypt produced single superphosphate from phosphate rock and sulfuric acid. The triple superphosphate plant at Abu Zaabal was scheduled to produce 175,000 tons of triple superphosphate and 200,000 tons of phosphoric acid per year when fully onstream sometime in 1981. The triple superphosphate unit was completed in 1979 by Bradley Pulverizer (United Kingdom). Lurgi (Federal Republic of Germany) and Babcock-Moxley (United Kingdom) were contracted for construction of the phosphoric acid plant and handling facilities. The Abu Zaabal complex consisted of two single superphosphate plants and two sulfuric acid plants. In addition to the triple superphosphate and phosphoric acid units under construction, a third sulfuric acid plant was to be added to the Abu Zaabal complex. Krebs of Paris (France) was awarded the contract for the design, engineering, and equipment supply for the plant. Design capacity was 215,000 tons per year of sulfuric acid, and 100,000 tons per year of 65% oleum.

Phosphate.—Plans were underway in 1980 for expansion and development of Egypt's two major phosphate deposits, West Sabaya and Abu Tartur. Phosphate deposits in the Eastern Desert, at Safaga and El Kosseir were nearly depleted, while production at Hamrawein, also in the Eastern Desert, increased substantially.

Overall phosphate production increased almost 20% in 1980 over 1979 levels. Production continued from the Red Sea coast, at Kosseir and Safaga, where reserves were estimated at 150 million tons, and from the Nile Valley area, at West Sabaya and Mahamid, where reserves were estimated at 400 million tons.

The expansion of the West Sabaya Mine, 31 kilometers north of Idfu on the Nile River, was postponed early in 1980 when a $27 million grant from the United Kingdom's Ministry of Overseas Development Administration was withheld following the United Kingdom Government's cutback on expenditure. The expanded mine and beneficiation plant were intended to supply the new phosphoric acid and triple superphosphate plant at Abu Zaabal. Egypt continued to seek development aid for the project.

Action was taken in 1980 on developing Egypt's largest phosphate deposit at Abu Tartur in the Western Desert. Reserves at Abu Tartur were estimated at 1 billion tons of phosphate rock with an average P_2O_5 content of 25.6%. The deposit had been examined for several years, without any development plans, due mainly to problems in beneficiation and separation of finely disseminated pyrite, and the high cost of associated infrastructure. In 1980, Occidental Petroleum Co. (United States) drew up a $1.5 billion plan to develop the deposit. In 1978, the World Bank approved an $11 million loan to set up a 500,000-ton-per-year pilot plant and mine, and construction was carried out by Sofremines (France) and Alusuisse (Switzerland). The pilot plant operation was encouraging enough to draw Occidental's attention toward developing the deposit. Should Occidental proceed with their plan, total capacity of Abu Tartur would exceed 4 million tons per year of ore, processed to produce 175,000 tons per year of triple superphosphate and 350,000 tons per year of phosphoric acid. Infrastructure development was to include building an entire town, construction of a 480-kilometer railroad from Abu Tartur to the Port of Safaga, and expansion of handling facilities at Safaga.

Salt.—Egypt was planning a major project to produce salt, magnesia, and sodium sulfate from a new facility to be located at Lake Quarun. With a $25 million aid grant from the United States, Egypt planned to produce 200,000 tons per year of high-grade (99% NaCl) salt, 21,000 tons per year of magnesia, and 7,500 tons per year of sodium

sulfate. The salt was to be marketed for consumption domestically and for export, while the sodium sulfate was to be used in the domestic detergent industry. Magnesium oxide was expected to be used in the developing refractories industry in Egypt. Feasibility studies regarding production process and plants for the Lake Quarun facility were carried out by DSS Engineers (United States) and White Consultants (United Kingdom).

Sulfur.—Feasibility studies continued on the sulfur deposits in the Siwa Oasis area of northwest Egypt at Taaweeny. Egypt remained under pressure to develop its sulfur deposits after Iraq banned all exports to Egypt in 1979. Egypt had been a major customer of the Iraqi sulfur industry before the Camp David agreements and the Arab boycott. Construction of four sulfur grinding plants was nearing completion in 1980. The plants were to grind 20,000 tons per year of sulfur rock into sulfur powder. The plants were being constructed by Klockner A.G. (Federal Republic of Germany) under contract from the Chama Sulfur Co. of Egypt.

Trona.—Egypt's production of natural sodium carbonate remained constant during 1980. The major source was the trona deposits of Wadi Natrun, northwest of Cairo. The entire output of the mine was used in the Misr Chemical Manufacturing Co. plant near Alexandria. The plant used imported and domestic sodium carbonate in the production of 45,000 tons of caustic soda, 5,000 tons of sodium bicarbonate, and 82,000 tons of heavy sodium carbonate per year.

MINERAL FUELS

Coal.—Egypt regained control in 1980 of a significant coal deposit in the north-central Sinai Pennisula. The Maghara coal deposit was first discovered in 1959, and mined until the June war of 1967. The Maghara deposit contained 27.5 million tons of proved reserves, with an additional 11 million tons of probable reserves. The Egyptian Government allocated $21 million in 1980 for complete plans to renew mining activity of Maghara. The annual output, once operations begin, is expected to be 800,000 tons. The coal was to be combined with imported Polish coal to produce coke for the Helwan steel plant.

Natural Gas.—Egypt marketed around 60 billion cubic feet of natural gas during 1980, most of which was directed toward power generation, fertilizer production, and industrial uses. Nonassociated gas was produced from three fields: Abu Madi, Abu Qir, and Abu Gharadig, where total reserves were estimated at 5 trillion cubic feet. About 300 million cubic feet per day of associated gas was also produced at the Gulf of Suez oilfields, most of which was flared. In 1979, the World Bank's International Bank for Reconstruction and Development granted the Egyptian General Petroleum Authority (EGPA) a $75 million loan to partly finance a project to gather, process, and transport the associated gas. The project was to include three gas-gathering stations; a liquefied petroleum gas (LPG) and condensate recovery plant; compression facilities; a pipeline; and engineering, technical, and training services. The initial phase of the project was to collect up to 40 million cubic feet of gas per day from a gas-gathering station at Ras Bakr and transport it by a 16-inch pipeline to a processing and compression station south of Ras Shukair. The total cost of the venture was $167 million, and was to be completed by 1982.

Production from the gasfields at Abu Madi was scheduled to increase fivefold by the mid-1980's as new wells come onstream. Natural gas from Abu Madi was used to support industrial development in the area, and provide feedstock for the Talkha I and II fertilizer complexes.

Production from the Abu Gharadig Field averaged around 60 million cubic feet per day. Gas from Abu Gharadig was supplied to cement plants at Helwan and Turah, as well as the iron and steel plant at Helwan.

Production from the offshore Mediterranean Abu Qir Field began in 1979 at around 100 million cubic feet per day and was scheduled to reach 200 million cubic feet per day by the mid-1980's. The gas was used in the Abu Qir fertilizer plant, nearby power-generating facilities, and industrial plants in Kafr al-Dawar and Demanhur. EGPA also drew up a plan in 1980 to utilize natural gas instead of bottle gas in residences around Cairo. Tenders were issued for the construction of a natural gas distribution system in the Cairo area. The project was scheduled for completion in 1982.

The Elf-Aquitane group (France) made a substantial gas discovery 20 kilometers northeast of Alexandria in their offshore Mediterranean concession. Initial reports indicated that the field was at least as large as the nearby Abu Qir Field, and possibly much larger. Elf planned to continue drilling in the area to evaluate the actual size of the discovery. The group also submitted proposals to the Egyptian Oil Minister for

the construction of a $950 million gas liquefaction plant onshore at Abu Qir. No decision was made by the ministry during the year.

Petroleum.—*Production.*—Egypt's oil production increased nearly 20% in 1980 over 1979 levels, due mostly to the new producing wells in the Gulf of Suez and the recovery of oilfields lost as a result of the June war of 1967. Egypt planned to attain a production target of 1 million barrels per day by 1985. Production for 1980 averaged 590,000 barrels per day. With new discoveries in 1980, Egyptian petroleum reserves stood at 2.3 billion barrels. The EGPA supervised all exploration, production, refining, and marketing of crude and refined petroleum. The spot price of Egypt's Gulf of Suez blend reached $40 per barrel at the end of 1980, while the official price was raised to $36 per barrel in December of 1980.

The Gulf of Suez continued to be the major oil-producing area in Egypt during 1980. The increase in production during the year was largely brought about by increased drilling in existing oilfields, and not by new discoveries, which were still under evaluation. The major fields in the Suez were operated by the Gulf of Suez Petroleum Co. (GUPCO), a joint venture of Amoco Egypt Oil Co. and EGPA. The July, El Morgan, and Ramadan Fields all averaged near 100,000 barrels per day in 1980. Production from the Gulf of Suez fields was slightly reduced midway through 1980 in an attempt to conserve reserves. Egypt's total oil production for the second half of 1980 averaged around 545,000 barrels per day as a result of reduced output from these fields. Production from the Shi'ab Ali (formerly Alma) Field, returned to Egypt in 1979, was reduced from 40,000 to 15,000 barrels per day to prevent damage to the field.

Production from oilfields in the Sinai also increased during 1980. The major field in the Sinai, Abu Rudeis, increased production from 50,000 barrels per day in 1979 to an average 90,000 barrels per day in 1980. The Abu Rudeis Field was operated by Cie. Orientale des Petroles d'Egypte (COPE), a joint venture of EGPA and ENI (Italy). Nearly two-thirds of the Sinai was returned to Egypt in January 1980, as part of the Egypt-Israel Peace Treaty, much of which was opened up for exploration during the year.

The General Petroleum Co. (GPC), owned totally by the Egyptian Government, produced oil from seven fields in the Eastern Desert. The Egyptian Petroleum Development Co. (Epedeco) group of Japan started production from the West Bakr onshore field in the Eastern Desert. The field came onstream in June 1980 at 3,400 barrels per day. Other oil companies operating in Egypt were the Western Desert Petroleum Co. (WEPCO), a joint Phillips Petroleum Co.-EGPA venture; Fayum Petroleum Co. (FAPCO), a joint venture of Amoco and the EGPA; and the Nile Valley Petroleum Co. (NIPCO), another Amoco-EGPA company.

Exploration.—In recent years, Egypt has attempted to attract the major oil companies into oil exploration and joint venture concessions. During the 1970's, 75% of the cost of developing the country's oil reserves came from EGPA's foreign partners, and EGPA's management emphasized that new agreements would be liberal and negotiable. Favorable terms and large unexplored areas prompted 36 concession agreements to be signed during 1980, 15 of which were with U.S. companies. Exploration capital committed by these agreements alone was in excess of $500 million.

Exploration in the Gulf of Suez continued to be the most profitable, with several new discoveries. Amoco, Deminex, Petrobel, CFP-Total and Mobil Oil Corp. all had commercially viable discoveries during 1980. Details of these discoveries are listed in the following tabulation.

Location	Company	Initial flow (barrels per day)	API gravity
Gulf of Suez	Amoco	8,720	28.2
Northwest Gulf of Suez	do	9,300	13.6
Gulf of Suez	do	6,790	40
Do	do	2,900	30
Do	Deminex	2,045	29.7
Do	do	1,900	15
Do	do	1,753	30
Do	do	1,860	Condensates
Feiron-onshore	Petrobel	1,080	23
South Rudeis-onshore	do	770	17.5
Gulf of Shugair	CFP-Total	3,280	35
Gulf of Suez-Red Sea	Mobil	2,948	23

Most interesting was Mobil's strike in the Red Sea. The area had not been considered to have great potential for oil, but the new discovery was likely to prompt more thorough exploration efforts. New exploration agreements in the Gulf of Suez were also signed by CFP-Total, Petrofina, and Conoco.

As a result of the 1979 Peace Treaty between Egypt and Israel, nearly two-thirds of the Sinai Peninsula was returned to Egypt in 1980. The Sinai coast, or the "oil corridor," and offshore areas in the Mediterranean Sea were considered as having good potential for oil reserves. The EGPA signed production-sharing agreements for concessions in both areas—with Conoco for a 1,600-square-kilometer tract in Ras Muhammad, South Sinai, committing $113 million over 3 years; with BP for a 1,200-square-kilometer tract in the Mediterranean-North Sinai Area; with the International Egyptian Oil Co., an affiliate of Italy's ENI, for a 1,200-square-kilometer tract in the same area; and with CFP-Total for a 1,200-square-kilometer offshore Mediterranean concession. Terms offered by the EGPA allowed the companies to recover their costs out of 30% of production for onshore areas, and 40% for offshore areas.

Contracts and agreements were also signed in other areas in Egypt. Agypetco (Switzerland-Federal Republic of Germany) signed an agreement with EGPA for an 1,800-square-kilometer concession in the Razzak West Area of the Western Desert, and a 5,800-square-kilometer concession in the Qattara depression in the Northwest Desert was awarded to Shell Winning N.V. (Netherlands). Other companies who signed production-sharing agreements during the year with EGPA include Gulfstream Resources Ltd. (Canada), Medoil-Mediterranean Oil and Gas Co., L.K. Exploration, Brinco Group (Canada), and Polar Bear Co. (Canada).

Refining.—Around 45% to 48% of Egypt's crude petroleum production was refined within the country in six refineries operated by three public companies. A small amount of petroleum products was imported in 1980, mainly from Western Europe. Egypt planned to increase refinery output from 85 million barrels per year to 110 million barrels per year to keep pace with the increase in domestic consumption. Egypt's refinery capacities were as follows in thousand barrels per year:

Company	Location	Capacity
Suez Petroleum Co	Suez	10,000
	Musturud	25,000
	Tanta	10,000
El Nasr Petroleum Co	Suez	7,000
	Ameriyah	15,000
Alexandria Petroleum Co	Alexandria	15,000

Construction continued on the $100 million lube oil complex at the Alexandria Petroleum Co.'s refinery. The unit was scheduled to produce 54,000 tons per year of lube oil, 16,000 tons per year of cylinder oil, 100,000 tons per year of asphalt, and 11,000 tons per year of micro wax.

Work began in 1980 on Egypt's first petrochemical complex, to be located at Ameriyah, near Alexandria. The complex is scheduled to come onstream in 1982 with an annual production capacity of 80,000 tons of polyvinyl chloride, 90,000 tons of low-density polyethylene, and 50,000 tons of high-density polyethylene. Ethylene feedstock was to be imported from Montedision of Italy, and in return, Egypt was to supply Montedison with sufficient naphtha to produce the ethylene needed. The complex was owned 75% by EGPA and 25% by Montedison. Total cost of the complex was estimated at $550 million.

Pipelines.—The second line of the Sumed pipeline began operating in September 1979. Total capacity of the line was 590 million barrels per year. The pipeline, which runs between Suez on the Red Sea, and Alexandria on the Mediterranean, operated at the rate of 1.6 million barrels per day in 1979-80. Around 50% of the pipeline's capacity was reserved by seven major oil companies. Saudi Arabia continued to investigate the possibility of using the Sumed pipeline in conjunction with its Abqaiq-Yanbu transpeninsular line to facilitate shipping Saudi crude to Western Europe. Saudi Arabia would put through up to 1 million barrels per day starting in 1982, but these plans appeared less likely since the Arab boycott was imposed on Egypt after signing the peace treaty in 1979.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Egyptian pounds (E£) to U.S. dollars ($) at the rate E£0.70=US$1.00.

The Mineral Industry of Finland

By Joseph B. Huvos[1]

In 1980, Finland, which is a modest producer of mineral commodities, sustained a continued strong growth of the economy, with unemployment down to about 4.7% and inflation on the rise at about 13.5%. The gross national product (GNP) was about $50 billion.[2] The contribution of mining and quarrying remained minor, but manufacturing, mining, and quarrying together contributed about 27% of the GNP. There were several noteworthy events in the Finnish mineral industry in 1980. Plant commissionings included the starting of a nuclear powerplant, and of a ladle injection steel plant. Work was started to raise the capacity of several existing plants, including the country's sole ferrochrome plant, the only electrolytical copper refinery, copper smelter, and steel billet treatment plant. Work started on the construction of a sulfuric acid plant. Exploration for mineral deposits continued in many areas, including the Talvivaara copper-nickel-cobalt-zinc deposit and the Luikonlahti talc deposit. Agreements were reached to expand domestic apatite production and also to expand an iron ore pellet project in the Soviet Union near the Finnish border.

PRODUCTION

Production of mineral commodities in 1980 and the 4 previous years is shown in table 1.

Volume indices (1975=100) for the production of the country's mineral industry and its industry as a whole are shown in the following tabulation:

Sector	1979	1980[p]
Mining and quarrying	126	129
Nonmetallic mineral processing	103	104
Iron and steel	168	166
Nonferrous metals	147	150
Petroleum refining	154	162
Industrial chemicals	113	111
All industry	118	125

[p]Preliminary.

Source: Central Statistical Office of Finland, Helsinki. Bulletin of Statistics No. 2. 1981, pp. 8-9.

Table 1.—Finland: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal, secondary	6,100	7,400	7,000	8,000	8,000
Cadmium metal, refined	428	527	611	590	581
Chromium: Chromite:					
Gross weight:					
Lump ore	239,112	233,129	328,542	257,107	340,952
Concentrate	143,302	145,131	160,865	152,297	
Foundry sand	31,567	23,740	17,559	25,289	
Cr_2O_3 content:					
Lump ore	63,604	62,479	86,078	69,419	NA
Concentrate	57,894	59,939	66,116	66,880	NA
Foundry sand	14,679	11,087	8,200	11,100	NA
Cobalt:					
Mine output, metal content	1,278	1,227	1,296	1,139	1,035
Metal, refined	892	985	922	1,162	1,151
Copper:					
Mine output, metal content	41,729	46,728	46,865	41,063	36,918
Metal:					
Smelter:					
Primary	51,516	61,542	53,737	55,300	49,200
Secondary	9,527	10,563	9,990	9,900	10,000
Total	61,043	72,105	63,727	65,200	59,200
Refined:					
Primary[e]	34,149	32,755	32,719	33,027	30,542
Secondary[e]	4,000	10,000	10,000	10,000	10,000
Total	38,149	42,755	42,719	43,027	40,542
Gold metal troy ounces	26,299	27,392	29,096	28,325	41,828
Iron and steel:					
Iron ore, marketable, all types:					
Gross weight thousand tons	1,167	1,141	1,088	1,144	1,172
Fe content do	768	753	712	738	755
Metal:					
Pig iron do	1,329	1,763	1,916	2,038	2,054
Ferroalloys: Ferrochromium do	40	34	45	49	53
Steel, crude:					
Ingots do	1,614	2,171	2,304	2,469	2,488
Castings do	30	25	29	30	[e]30
Semimanufactures, rolled do	1,616	1,518	1,804	1,900	1,900
Lead, mine output, metal content	1,131	628	790	1,000	1,134
Mercury 76-pound flasks	383	630	1,145	1,347	2,170
Molybdenum metal	--	--	--	104	114
Nickel:					
Mine output, metal content	6,358	5,837	4,407	5,800	6,531
Nickel sulfate, metal content	190	223	173	NA	NA
Metal, electrolytic	7,624	9,447	7,501	11,460	12,807
Platinum metal[e] troy ounces	600	640	640	720	NA
Selenium metal kilograms	9,931	11,654	16,830	17,541	17,250
Silver metal troy ounces	773,256	812,898	1,068,850	1,027,729	1,429,581
Titanium concentrate: Ilmenite:					
Gross weight	122,600	124,700	131,900	119,700	159,000
Ti content	56,028	56,240	59,750	54,223	72,026
Vanadium (V_2O_5):					
Gross weight	2,589	3,328	5,007	4,941	5,076
V content	1,450	1,864	2,805	2,768	2,844
Zinc:					
Mine output, metal content	61,143	62,856	52,923	51,623	58,433
Metal	110,633	137,980	132,935	147,064	146,719
NONMETALS					
Cement, hydraulic thousand tons	1,825	1,712	1,704	1,749	1,793
Feldspar	68,213	71,890	71,330	67,928	74,089
Lime	250,000	235,000	194,101	[r e]200,000	[e]197,000
Nitrogen: N content of ammonia	168,100	131,400	149,900	114,200	70,100
Phosphates, natural: Apatite	4,187	2,550	4,218	2,688	137,950
Pyrite, gross weight	494,118	295,015	215,765	341,967	321,797
Sodium compounds: Sodium sulfate[e]	63,000	45,000	50,000	45,000	45,000
Stone:					
Limestone and dolomite:					
For cement manufacture thousand tons	2,394	2,535	2,287	2,339	2,534
For lime manufacture do	462	430	387	439	392
For sulfite and metallurgical use do	128	98	81	80	82
Other do	1,267	901	1,055	1,241	1,428
Quartz do	109	119	145	217	237

See footnotes at end of table.

Table 1.—Finland: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sulfur:					
S content of pyrite thousand tons	234	130	87	151	144
Byproduct:					
Of metallurgy do	283	280	232	263	[e]260
Of petroleum do	25	25	30	30	30
Total do	542	435	349	444	434
Talc	148,531	156,584	195,159	267,180	317,901
Wollastonite	6,165	8,904	7,688	10,576	8,782
MINERAL FUELS AND RELATED MATERIALS					
Peat:					
For fuel use thousand tons	360	600	1,870	1,551	[e]1,450
For agriculture and other uses do	198	231	203	773	[e]820
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	14,235	15,630	16,737	17,508	NA
Jet fuel do	1,554	1,582	1,765	1,806	NA
Kerosine do	30	34	29	40	NA
Distillate fuel oil do	23,990	29,060	26,993	28,000	NA
Residual fuel oil do	27,255	27,330	24,707	24,997	NA
Liquefied petroleum gas do	1,007	1,163	8,468	1,188	NA
Other do	5,506	8,539		8,477	NA
Refinery fuel and losses do	8,203	5,269	4,629	5,035	NA
Total do	81,780	88,607	83,328	87,051	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through July 17, 1981.

TRADE

Since 1975, exports had fueled the Finnish economy, but in 1979 a downturn started in the trade balance; in 1980 the current account deficit was projected at $1.5 billion. Finland's mineral commodity trade in 1978 and 1979 are shown in tables 2 and 3.

Table 2.—Finland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Scrap	644	(1)	--	(1)
Unwrought	2,652	1,337	--	Sweden 909; Japan 256.
Semimanufactures	38,580	23,277	NA	West Germany 5,377; Denmark 3,763; United Kingdom 3,464.
Cadmium metal including alloys, all forms	507	(2)	(2)	(2)
Chromium: Chromite	364,461	308,847	8,508	Sweden 264,223; France 14,715.
Cobalt metal including alloys, all forms	853	(2)	(2)	NA.
Copper metal including alloys:				
Scrap	218	521	--	Mainly to Denmark.
Unwrought	17,542	16,893	92	East Germany 5,472; Spain 3,777; West Germany 2,899.
Semimanufactures	26,865	29,158	2,105	United Kingdom 7,023; Sweden 4,547; France 3,748.
Gold metal, including alloys, unwrought and wrought troy ounces	4,710	NA	NA	NA.
Iron and steel:				
Ore and concentrate	13,302	NA	NA	NA.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	973	3,661	--	West Germany 2,702.
Pig iron, spiegeleisen, similar materials	r114,952	32,513	--	Italy 10,851; Spain 7,100; Sweden 4,265.
Ferroalloys	42,802	31,735	--	Sweden 11,718; France 6,463; West Germany 5,478.
Steel, primary forms	r191,049	163,350	--	Sweden 58,950; United Kingdom 48,716; West Germany 33,028.
Semimanufactures				
Bars, rods, angles, shapes, sections	174,890	222,447	4,762	West Germany 41,099; U.S.S.R. 37,845; Sweden 21,246.
Universals, plates, sheets	739,788	667,929	135,653	West Germany 150,050; Sweden 93,599; Denmark 57,458.
Hoop and strip	26,815	33,422	398	Sweden 13,827; West Germany 8,143; U.S.S.R. 3,596.
Rails and accessories	797	308	NA	East Germany 10.
Wire	2,474	4,657	NA	Sweden 2,010; U.S.S.R. 1,245; Norway 591.
Tubes, pipes, fittings	57,809	68,278	NA	Sweden 32,932; U.S.S.R. 12,008; West Germany 5,458.
Castings and forgings, rough	1,799	3,292	--	Sweden 1,754; Hungary 492; West Germany 249.
Lead:				
Ore and concentrate	2,022	2,035	--	Mainly to West Germany.
Metal including alloys:				
Scrap	342	102	--	All to Sweden.
Unwrought	808	991	--	Austria 305; Denmark 297; Sweden 214.
Semimanufactures	214	59	--	Austria 49; Sweden 3.
Mercury 76-pound flasks	403	NA	NA	NA.
Nickel:				
Ore and concentrate	--	686	54	Norway 632.
Metal including alloys:				
Scrap	571	146	--	Norway 59.
Unwrought	5,882	9,578	2,393	France 2,004; United Kingdom 1,033; West Germany 892.
Semimanufactures	11	5	--	NA.
Platinum-group metals including alloys, unwrought and wrought troy ounces	13	(3)	(3)	(3)
Silver metal including alloys, unwrought and wrought thousand troy ounces	722	(4)	(4)	(4)
Tin metal including alloys:				
Scrap	79	14	--	United Kingdom 11.
Unwrought	4	NA	NA	NA.
Semimanufactures	1	NA	NA	NA.
Titanium oxides	2,264	NA	NA	NA.
Vanadium oxides	4,931	NA	NA	NA.
Zinc:				
Oxides	596	NA	NA	NA.
Metal including alloys:				
Scrap	6	501	NA	United Kingdom 273.
Unwrought	113,605	129,565	29,811	United Kingdom 41,218; Netherlands 14,741; Sweden 14,527.
Semimanufactures	65	56	--	NA.
Other:				
Ash and residue containing nonferrous metals	1,929	14,037	--	Sweden 1,933; Denmark 790; West Germany 529.
Waste and sweepings of precious metals kilograms	11,254	7,031	--	United Kingdom 3,065; Sweden 2,307; Denmark 990.
Base metals including alloys, all forms	r71	21,876	747	United Kingdom 288; West Germany 246; Sweden 131.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	36	58	NA	NA.
Cement	76,665	217,547	--	Sweden 141,054; U.S.S.R. 45,837; Nigeria 23,464
Chalk	65	(5)	NA	NA.
Clays and clay products (including all refractory brick):				
Crude clays:				
Kaolin	114	(5)	NA	NA.
Other	714	(5)	NA	NA.
Products:				
Refractory including nonclay brick	r2,112	732	--	NA.
Nonrefractory	r891	2,405	NA	U.S.S.R. 1,458; Sweden 538.

See footnotes at end of table.

Table 2.—Finland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond, all grades ____ carats	r1,750	(6)	NA	NA.
Diatomite and other infusorial earth	8	(5)	NA	NA.
Feldspar, leucite, nepheline syenite	54,082	(5)	NA	NA.
Fertilizer materials, manufactured:				
Nitrogenous	41,149	62,416	NA	Mainly to India.
Phosphatic	7	6	NA	NA.
Potassic	r23,117	8,796	--	All to East Germany.
Other including mixed	120,542	205,668	--	Venezuela 41,012; China, mainland 27,500; Thailand 22,054.
Lime	318	116	NA	NA.
Precious and semiprecious stones, except diamond:				
Natural ____ kilograms	1,666	NA	NA	NA.
Synthetic ____ do	1	(7)		
Salt and brines	52	148	NA	Hong Kong 81.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	3	NA	NA	NA.
Stone, sand and gravel:				
Dimension stone	101,309	149,649	NA	Italy 73,407; France 34,969; West Germany 14,993.
Gravel and crushed rock	134,473	52,490	NA	Sweden 47,268; U.S.S.R. 5,147.
Limestone except dimension	11,103	(5)	NA	NA.
Quartz and quartzite	1,086	(5)	NA	NA.
Sand excluding metal-bearing	90,846	17,502	NA	Saudi Arabia 3,395.
Sulfur:				
Elemental, all forms	8	NA	NA	NA.
Sulfuric acid	113,128	NA	NA	NA.
Talc and steatite, soapstone, pyrophyllite	27,609	(5)	NA	NA.
Other:				
Crude	6,254	5122,354	NA	Sweden 39,353; United Kingdom 36,693; West Germany 14,485.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	30	NA	NA	NA.
Other	13	NA	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	4,622	5,768	--	U.S.S.R. 2,453; Norway 1,417; Sweden 1,020.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	436	NA	NA	NA.
Carbon black	11	NA	NA	NA.
Coke and semicoke	612	2,080	--	Mainly to Norway.
Hydrogen, helium, rare gases kilograms	1,400	NA	NA	NA.
Peat including briquets and litter	17,241	30,028	NA	Netherlands 9,808; United Kingdom 5,884.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	4,923	4,342	205	Sweden 3,290; Netherlands 523; United Kingdom 207.
Kerosine ____ do	r154	82	--	Mainly to Denmark.
White spirit ____ do	471	NA	NA	NA.
Jet fuel ____ do	154	NA	NA	NA.
Distillate fuel oil ____ do	3,950	1,150	--	Sweden 1,067; U.S.S.R. 82.
Residual fuel oil ____ do	3,459	2,818	--	Sweden 2,078; West Germany 319; United Kingdom 259.
Lubricants ____ do	124	113	NA	U.S.S.R. 55; Nigeria 45.
Other:				
Liquefied petroleum gas ____ do	64	20	NA	Mainly to Cuba.
Mineral jelly and wax ____ do	12	NA	NA	NA.
Nonlubricating oils ____ do	4	NA	NA	NA.
Petroleum coke, bitumen, bituminous mixtures ____ do	28	25	--	U.S.S.R. 22; Sweden 2.

rRevised. NA Not available.

[1] Aluminum scrap, if any, is included in "Other: Ash and residue containing nonferrous metals."

[2] Exports, if any, of metallic cadmium, cobalt, and tin in any form (except tin scrap) are included in "Other: Base metals including alloys, all forms."

[3] Quantity not available; exports valued at $389,000, mainly to West Germany and the United Kingdom.

[4] Quantity not available; exports valued at $4,932,000, mainly to Sweden and West Germany.

[5] Exports, if any, of chalk, crude clays, diatomite, feldspar, leucite, nepheline syenite, limestone, quartz, talc, steatite, soapstone, and pyrophyllite, are included in "Other: Crude."

[6] Quantity not available; exports valued at $499,000, mainly to the United Kingdom and West Germany.

[7] Quantity not available; exports valued at $569,000, mainly to the United States.

Table 3.—Finland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	265	4,495	NA	West Germany 2,548; United Kingdom 938; Denmark 836.
Oxide and hydroxide	24,333	NA	NA	NA.
Metal including alloys:				
Scrap	13	3,849	1,832	Norway 673; Sweden 544; West Germany 400.
Unwrought	r21,711	24,891	154	U.S.S.R. 9,700; Norway 5,075; Hungary 4,735.
Semimanufactures	24,410	32,243	328	Sweden 8,919; Norway 3,988; West Germany 3,821.
Antimony metal including alloys, all forms	39	(1)	(1)	(1)
Beryllium metal including alloys, all forms kilograms	100	(1)	(1)	(1)
Cadmium metal including alloys, all forms do	13,300	(1)	(1)	(1)
Chromium, oxide and hydroxide	296	NA	NA	NA.
Cobalt:				
Oxide and hydroxide	15,252	NA	NA	NA.
Metal including alloys, all forms	306	(1)	(1)	(1)
Copper:				
Ore and concentrate	4,192	24,706	NA	Sweden 10,794; Norway 6,215; Ireland 4,887.
Sulfate	368	NA	NA	NA.
Metal including alloys:				
Scrap	366	1,002	847	Sweden 70.
Unwrought	14,333	12,392	NA	West Germany 5,600; U.S.S.R. 5,004.
Semimanufactures	7,859	9,874	70	Sweden 4,214; West Germany 2,215; United Kingdom 1,558.
Gold metal, unworked or partly worked troy ounces	67,333	NA	NA	NA.
Iron and steel:				
Ore and concentrate, except roasted pyrite thousand tons	1,530	1,791	--	Sweden 1,206; U.S.S.R. 349; Norway 200.
Metal:				
Scrap	22,832	88,213	15,250	U.S.S.R. 58,202; West Germany 6,880; United Kingdom 6,294.
Pig iron including cast iron	2,212	14,364	--	Brazil 5,670; Sweden 5,002; Canada 3,261.
Sponge iron, powder, shot	4,303	5,388	--	Sweden 2,409; United Kingdom 1,114; Czechoslovakia 595.
Ferroalloys	33,030	47,437	--	Norway 19,886; U.S.S.R. 11,593; Greece 6,711.
Steel, primary forms	r13,645	1,813	--	Sweden 874; West Germany 873.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r156,223	214,240	11	Sweden 67,494; West Germany 30,862; Norway 19,741.
Universals, plates, sheets	r119,252	127,422	1,772	West Germany 26,638; Sweden 19,006; Czechoslovakia 18,431.
Hoop and strip	r27,390	25,852	NA	Sweden 8,694; West Germany 6,357; United Kingdom 5,201.
Rails and accessories	2,752	2,488	--	Sweden 832; Belgium-Luxembourg 812; West Germany 616.
Wire	r15,829	18,486	156	Sweden 6,061; France 4,033; United Kingdom 2,376.
Tubes, pipes, fittings	r90,407	103,314	52	West Germany 29,045; United Kingdom 16,765; Sweden 10,118.
Castings and forgings, rough	r1,263	1,906	--	Sweden 645; West Germany 524; Switzerland 295.
Lead:				
Oxide	152	NA	NA	NA.
Metal including alloys				
Unwrought	12,332	16,306	--	U.S.S.R. 7,710; Sweden 6,972; West Germany 930.
Semimanufactures	637	526	NA	West Germany 252; Denmark 216.
Magnesium metal including alloys, all forms	89	(1)	(1)	(1)
Manganese				
Ore and concentrate	19,737	18,916	NA	China, mainland 1,400.
Oxide	2,068	NA	NA	NA.
Mercury 76-pound flasks	316	NA	NA	NA.
Molybdenum:				
Ore and concentrate	40,111	NA	NA	NA.
Metal including alloys, all forms	2	(1)	(1)	(1)

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Ore and concentrate	14,275	21,968	NA	Norway 14,798; Canada 3,882; France 3,283.
Metal including alloys:				
Scrap	924	1,176	885	United Kingdom 137; Netherlands 91.
Unwrought	4,547	2,846	1,515	U.S.S.R. 681; Canada 570.
Semimanufactures	49	66	16	West Germany 27; United Kingdom 14.
Phosphorus, elemental	8	NA	NA	NA.
Platinum-group metals including alloys, unwrought and wrought troy ounces	7,867	(2)	(2)	(2)
Silver metal including alloys, unwrought and wrought thousand troy ounces	1,564	(3)	(3)	(3)
Silicon, elemental	441	NA	NA	NA.
Tin metal including alloys:				
Scrap	13	NA	NA	NA.
Unwrought	211	302	--	United Kingdom 69; West Germany 55; Denmark 51.
Semimanufactures	111	105	--	United Kingdom 60; West Germany 21.
Titanium:				
Ore and concentrate	6,399	NA	NA	NA.
Oxide	95	NA	NA	NA.
Tungsten:				
Ore and concentrate	(4)	NA	NA	NA.
Metal including alloys, all forms	29	(1)	(1)	(1)
Zinc:				
Ore and concentrate	169,199	146,816	--	Denmark 71,229; Peru 38,614; Sweden 32,307.
Oxide	347	NA	NA	NA.
Metal including alloys:				
Blue powder	459	NA	NA	NA.
Unwrought	197	1,310	--	Peru 526; West Germany 224; Poland 191.
Semimanufactures	671	1,000	--	Norway 688; United Kingdom 85; Sweden 53.
Zirconium ore and concentrate	3,067	NA	NA	NA.
Other:				
Ores and concentrates	860	NA	NA	NA.
Ash and residue containing nonferrous metals	2,566	3,150	2,224	Philippines 773; United Kingdom 85.
Metals:				
Metalloids	r10	NA	NA	NA.
Alkali, alkaline earth, rare-earth metals	4	NA	NA	NA.
Base metals including alloys, all forms, n.e.s	140	1693	1377	West Germany 85;[1] Sweden 62.[1]
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, natural corundum, etc	101	NA	NA	NA.
Dust and powder of precious and semi-precious stones, except diamond kilograms	3	NA	NA	NA.
Grinding and polishing wheels and stones	1,667	2,082	342	Austria 531; Sweden 330; West Germany 298.
Asbestos	5,415	3,019	NA	Canada 778.
Barite and witherite	952	(5)	(5)	(5)
Borates, crude, natural	15,748	(5)	(5)	(5)
Cement	7,056	4,569	NA	Denmark 2,659; United Kingdom 953.
Chalk	9,286	(5)	(5)	(5)
Clays and clay products including all refractory brick:				
Crude clays:				
Kaolin	330,644	NA	NA	NA.
Other	22,436	NA	NA	NA.
Products:				
Refractory including nonclay brick	r49,626	59,575	101	United Kingdom 17,618; Sweden 14,427; West Germany 9,847.
Nonrefractory	r11,427	18,771	--	U.S.S.R. 6,832; Denmark 2,103; Italy 2,055.
Cryolite and chiolite	37	(5)	(5)	(5)
Diamond:				
Gem, not set or strung carats	21,050	(6)	(6)	(6)
Industrial do	11,650	(7)	(7)	(7)

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diatomite	1,295	(5)	(5)	(5)
Feldspar, leucite, nepheline syenite	1,917	(5)	(5)	(5)
Fertilizer materials:				
Crude, phosphatic	492,806	672,527	85,821	Senegal 262,505; Morocco 135,168; Algeria 97,047.
Manufactured:				
Nitrogenous	31,609	27,403	--	Norway 10,165; U.S.S.R. 6,781; Sweden 5,011.
Phosphatic	204	256	--	NA.
Potassic	243,382	300,015	--	U.S.S.R. 122,914; East Germany 100,132; West Germany 63,746.
Other including mixed	1,286	1,279	--	Belgium-Luxembourg 614; Sweden 251.
Ammonia	103,767	NA	NA	NA.
Fluorspar	2,204	(5)	(5)	(5)
Graphite, natural	104	(5)	(5)	(5)
Gypsum and plasters	83,558	NA	NA	NA.
Lime	17	8	NA	NA.
Magnesite	7,176	(5)	(5)	(5)
Mica, all forms	270	(5)	(5)	(5)
Pigments, mineral: Iron oxides, processed	2,871	NA	NA	NA.
Precious and semiprecious stones, except diamond:				
Natural kilograms	2,082	(8)		
Manufactured do	83	(9)		
Salt excluding brine	547,251	659,660	NA	Netherlands 405,829; East Germany 70,077; Poland 47,050.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	72,419	NA	NA	NA.
Caustic potash	474	NA	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,331	1,367	NA	Italy 441.
Worked	359	892	--	Italy 136.
Dolomite	17,540	(5)	(5)	(5)
Gravel and crushed rock	5,204	4,006	--	Sweden 2,135; Norway 1,046.
Limestone excluding dimension	627,693	(5)	(5)	(5)
Quartz and quartzite	276	(5)	(5)	(5)
Sand excluding metal-bearing	106,037	71,250	NA	Belgium-Luxembourg 34,310; Norway 17,827; Denmark 9,224.
Sulfur:				
Elemental:				
Other than colloidal	26,580	42,132	NA	France 21,437; Sweden 10,629; Poland 9,604.
Colloidal	1,859	NA	NA	NA.
Sulfuric acid, oleum	69	NA	NA	NA.
Talc, steatite, soapstone, pyrophyllite	656	(5)	(5)	(5)
Other:				
Crude	1,800	[5]588,618	21,381	United Kingdom 412,045; Norway 35,567.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	7,581	28,464	--	Sweden 23,151; Norway 5,200.
Slag and ash, n.e.s	2,550	NA	NA	NA.
Oxides and hydroxides of strontium, magnesium, barium	1,245	NA	NA	NA.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	4,453	6,449	--	Denmark 3,039; Norway 1,449; United Kingdom 831.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	414	NA	NA	NA.
Carbon black	7,338	NA	NA	NA.
Coal, all grades including briquets thousand tons	4,789	4,771	NA	Poland 4,013; U.S.S.R. 742.
Coke and semicoke do	930	1,263	--	U.S.S.R. 736; West Germany 365; Poland 100.
Gas, hydrocarbon, natural million cubic feet	29,996	30,721	--	All from the U.S.S.R.
Hydrogen, helium, rare gases	862	NA	NA	NA.
Peat including peat briquets and litter	6,924	NA	NA	NA.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	76,851	93,580	NA	U.S.S.R. 54,067; Saudi Arabia 15,278; Iran 10,289.

See footnotes at end of table.

Table 3.—Finland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Gasoline thousand 42-gallon barrels	237	150	NA	Netherlands 96; Denmark 15; Sweden 10.
Jet fuel ——do——	14	NA	NA	NA.
Kerosine ——do——	33	20	NA	U.S.S.R. 17; United Kingdom 3.
White spirits——do——	67	NA	NA	NA.
Distillate fuel oil ——do——	10,686	10,123	--	Mainly from U.S.S.R.
Residual fuel oil——do——	9,171	10,170	--	Do.
Lubricants ——do——	689	764	35	United Kingdom 239; Netherlands 146; U.S.S.R. 112.
Other:				
Liquefied petroleum gas do——	r133	133	--	Mainly from U.S.S.R.
Mineral jelly and wax do——	114	121	NA	West Germany 58; U.S.S.R. 28; United Kingdom 13.
Nonlubricating oils ——do——	53	NA	NA	NA.
Bitumen and bituminous mixtures ——do——	352	388	1	Netherlands 177; Denmark 167.
Pitch, pitch coke, petroleum coke ——do——	7	8	NA	United Kingdom 5; West Germany 3.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ——	337	NA	NA	NA.

rRevised. NA Not available.

[1]Imports, if any, of metallic antimony, beryllium, cadmium, cobalt, magnesium, molybdenum, and tungsten are included in "Other: Base metals including alloys, all forms."

[2]Quantity not available; imports valued at $697,000, mainly from the United Kingdom and Sweden.

[3]Quantity not available; imports valued at $6,785,000, mainly from the United Kingdom, Sweden, and West Germany.

[4]Less than 1/2 unit.

[5]Imports, if any, of barite, witherite, crude natural borates, chalk, crude clays, cryolite, chiolite, feldspar, leucite, nepheline syenite, fluorspar, graphite, magnesite, crude mica, dolomite, limestone, quartz, quartzite, talc, steatite, soapstone, and pyrophyllite are included in "Other: Crude."

[6]Quantity not available; imports valued at $6,069,000, mainly from Belgium-Luxembourg, the United Kingdom, and Switzerland.

[7]Quantity not available; imports valued at $175,000.

[8]Quantity not available; imports valued at $351,000, mainly from Switzerland and West Germany.

[9]Quantity not available; imports valued at $449,000, mainly from the United States and Switzerland.

COMMODITY REVIEW

METALS

Chromite.—Work started in 1980 to raise from 50,000 tons per year to 60,000 tons per year, the production capacity of the ferrochrome plant at Outokumpu Oy's Tornio works, located at the head of the Gulf of Bothnia. Construction is to be completed by the end of 1981. The quantity of ferrochrome available for sale is to decline, because of the increased demand in the stainless steel works. Company plans called for a doubling of stainless steel output in the 1980's from the present 140,000 tons per year. In 1980, preliminary figures for ferrochrome production were about 52,000 tons, and for rolled speciality steels, 76,000 tons.

In 1980, Outokumpu Oy remained the country's only chromite producer, with mines located at Kemi at the head of the Gulf of Bothnia. Under exploitation were the Viia ore body and the Elijärvi open pit. The company's ferrochrome plant and stainless steel plant were nearby at Tornio.

Cobalt and Molybdenum.—Outokumpu Oy decided to raise cobalt output at its Kokkola works on the west coast to 1,350 tons in 1981; 1980 production was about 1,200 tons. The increase was a result of an 8-year contract to buy residues from the Democratic Republic of Germany's Mansfeld copper smelter, which contain cobalt and molybdenum among other metals. Most of the cobalt product is to be exported, half of it to the United States. Finland's domestic consumption of cobalt was only 10 tons per year.

Copper, Nickel, Lead, and Zinc.—Exploration and process development work was started by Outokumpu Oy at the Talvivaara copper, nickel, cobalt, and zinc deposit near Sotkamo, near the center of the

country. Other major investment goals of the company were centered on the Pori plant on the west coast and the converting section of the Harjavalta smelter nearby. In Pori, capacity of the electrolytical copper refinery is to be expanded from 45,000 to 56,000 tons per year, the quantity of drawn products (wire) is to be expanded from 28,000 to 43,000 tons per year, rolling capacity is to be expanded from 16,000 to 20,000 tons per year.

In 1980, Outokumpu Oy's production of copper cathodes was about 41,000 tons, and the total of copper semiproducts was 51,500 tons. Production of nickel cathodes was about 12,800 tons, and zinc production was 146,000 tons.

In 1980, Myllikoski Oy, a paper manufacturing company, continued to produce copper ore at its Luikonlahti Mine, located near the Outokumpu Mine near the southeast border. The company increased prospecting activities for copper ores during the year. The Suomen Talkki Co. produced 4,400 tons of nickel concentrate during 1980, as a byproduct of the company's talc production.

Iron Ore.—In November 1980, an agreement was reached on the second and third stages of the Kostamus cooperative project in the U.S.S.R., signed during President Kekkonen's trip to Moscow. Stage 1, signed earlier, was to be completed in 1982. The agreement is to have a significant impact on Finnish-Soviet bilateral trade, and is to involve a value of $750 million and approximately 3,500 Finnish workers. The capacity of the mining industry complex will be expanded from 3 million to 9 million tons of iron ore pellets per year, and a town for 9,000 inhabitants will be built. The Finnish contractor, Finn-Stroi Oy, expected the final agreement with its Soviet counterpart, V. O. Promashimport, early in 1981. Indirectly the project employed 20,000 people in Finland, because 90% of the contract was covered by Finnish raw materials, machinery, and equipment. The Kostamus project, located 60 miles from the Finnish border town of Kainuu, was also important to Finland in alleviating the high unemployment (14%) in this area, because workers could commute across the border to their jobs. The unemployment rate was expected to fall to 11% during the life of the project.

Production of iron ore at Rautaruukki Oy's Rautavaara Mine in the north did not change significantly in 1980 and was 288,000 tons, but the Otanmäki Mine in central Finland increased production by approximately 15% to 522,000 tons. The company continued its 3-year-old project for mapping the country's iron ore deposits, which is being conducted in cooperation with the Finnish Geological Survey and Soviet experts.

Iron and Steel.—Ovako Oy decided to raise the share of special steel billets from 20% of its output to 30% of output by 1982. Speciality steel produced included high carbon and welding quality steels, cold heading grades (containing boron), and spring steels, mainly silicomanganese, as well as heat treatment steels for the engineering industry. As part of the expansion, the company has completed a ladle injection plant, and is to increase capacity of its billet treatment facilities.

Outokumpu Oy, the country's principal stainless steel producer, a Government-owned company, took over Oy Ja-Ro AB, formerly part of Oy Wilh. Schauman AB. Ja-Ro's activities are said to be unaffected by the takeover, and the company is to remain a separate company. The company bought most of its steel from Outokumpu Oy's Tornio works in northern Finland, and produced longitudinally welded stainless pipes and fittings, as well as vessels and tanks. Outokumpu Oy also bought the Gothenburg, Sweden-based steel importer, trader, and stockholder, Lennart Sjöstedt AB, and will rename it Outokumpu Svenska AB. The company has offices in Oslo and Paris.

NONMETALS

Apatite.—In 1980, Rautaruukki Oy continued prospecting and pilot-plant work at its Sokli apatite deposit in Kuopio Province. According to the company, evaluation of the project was making good progress.

Contracts were signed between two Government-owned companies, Outokumpu Oy and Kemira Oy, for the delivery of pyrite. Outokumpu's Pyhäsalmi Mine, in central Finland, was to supply 5 million tons of pyrite concentrate over a period of 15 years, which will be used for the production of sulfuric acid at Kemira's Siilinjärvi fertilizer plant, where the company's sulfuric acid capacity is to be raised from 300,000 to 500,000 tons per year. Until completion of the Siilinjärvi sulfuric acid plant expansion, the balance of sulfuric acid used is to be produced by the existing Kokkola plant on the west coast. According to the contract, phosphate rock mining operations at

Kuopio, central Finland, are to be expanded. Production of apatite concentrate is to be increased from the current level of 210,000 tons per year to around 500,000 tons per year. At present, the concentrate containing 36% P_2O_5 is produced from 2 million tons of ore containing 4% P_2O_5.

Industrial Minerals.—In 1980, Oy Lohja AB produced 1.2 million tons of dolomite limestone, 78,000 tons of burnt lime, and 604,000 tons of cement. Oy Partek AB produced 3 million tons of dolomite limestone, mainly for cement and lime, at six locations: Pargas, Villmanstrand, Kolari, Vimpeli, Siikainen, and Ankele. Kemira Oy produced 10,000 tons of calcite concentrate as a byproduct of its apatite process. Myllikoski Oy produced a byproduct talc concentrate at its Luikonlahti copper mine which is used by the company as a paper filler. Rauma-Repola Oy produced 200,000 tons of dolomite and 20,000 tons of quartzite.

Paraisten Kalkki Oy remained the country's largest cement producer, with three cement plants with a total capacity of 1.85 million tons. The plants were located at Pargas, south coast, Lappeeranta in south east, and Kolari in Finnish Lappland.

MINERAL FUELS

In 1980, Finland remained about 85% dependent on imported fuels, mostly crude oil, natural gas, nuclear fuel, coal, and coke. A major share of the crude oil and all natural gas was imported from the Soviet Union. Domestic fuel production was mainly hydroelectric power, peat, fuelwood, and industrial waste.

Nuclear Power.—Operations started at the second 660-megawatt electrical unit of the nuclear powerplant of Teollisuuden Voima Oy, located on the west coast at Olkiluoto Island, 13 kilometers north of Rauma. The plant was built by the AB Asea-Atom (Sweden) and the Työyhtymä Jukola Consortium (Finland).

Construction continued at the second 440-megawatt electrical unit of the nuclear powerplant of Imatran Voima Osakeythiö (IVO), located at Loviisa, about 80 kilometers east of Helsinki.

IVO has plans to build a third nuclear powerplant of 1,000 megawatt electrical of the Soviet VIS Atomenergoexport type in the general area of Helsinki. The plant would also provide about 1,000 megawatt of heat for long-distance space heating in the area.

Peat.—Vapo, the Finnish State Fuel Center, reported that production of peat in 1980 exceeded 6 million cubic meters. The peat bogs in production this year exceeded 23,000 hectares, while individuals owned and exploited 3,000 acres. The goal is to produce eventually 20 million cubic meters of peat. The Haukineva peat-coke plant, in southwest Finland, resumed operation at the rate of 100 tons of briquettes daily, for supplying private consumers.

Petroleum and Natural Gas.—Neste Oy, the Government-owned oil company, agreed to continue refining crude oil for Sweden during 1981 and 1982, at the rate of 1.5 million tons per year. Neste Oy had a total oil refining capacity of 15 million tons, located at Naantali on the west coast and at Porvoo on the south coast. Most of the country's oil imports and all its gas imports came from the Soviet Union pipeline. During the past 2 years, the price of oil was said to have increased well over twofold, but industrial exports to the Soviet Union could balance most of Finland's trade debts.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Finnish markka (Fmk) to U.S. dollars at the rate of Fmk4.11 = US$1.00 in 1980.

The Mineral Industry of France

By Roman V. Sondermayer[1]

France produced moderate quantities of minerals and was also an important processor of imported crude mineral commodities, including petroleum, during 1980. In some regions the mineral industry was a significant economic factor that provided employment and was essential for the well-being of the population. Some mines in France remained operational for social reasons during 1980.

The most prominent minerals and metals produced in France during 1980, with production expressed as approximate percentage of the world totals, were arsenic, 18.3; gypsum, 8.0; fluorspar, 5.9; and diatomite, 3.2. With the reorganization of France's Government agencies dealing with minerals and energy completed in 1979, the Government started to implement its policy more forcefully than in the past.

There were four basic ingredients in this policy: (1) To develop domestic resources, starting with a thorough inventory to develop information on known resources and to locate new deposits; (2) to improve recovery and utilization of materials; (3) to increase the security of foreign supplies by encouraging French involvement, both governmental and private, in foreign production, and by diversifying sources; and (4) to establish and maintain a raw materials stockpile. The policy is administered by the Ministry of Industry through its General Direction for Energy and Raw Materials, which comprises a number of operating agencies, notably the Bureau de Recherches Géologiques et Minières (BRGM).

In 1975, the Ministry of Industry put into practice a plan to inventory French domestic resources of nonferrous metals and other minerals. Its Comite de l'Inventaire du Territoire Metropolitain spent 142 million francs on this in 1975-79, and in Guyana about 38 million francs were spent for a similar purpose by the overseas section of the Counseil General des Mines. A forerunner of the plan was the so-called Copper Plan, started in 1973, which was the Government's first strong interest in minerals supply.

Since 1975, a number of programs have been implemented to economize on the use of raw materials (not only metals), to promote new and more economical products, and to improve primary and secondary recovery of metals. These programs include some of the steps taken under the Copper Plan and other metals plans.

France tries to ensure supplies of minerals from abroad by direct investment in foreign minerals industries; by political support of French minerals interests abroad; by rendering various services, such as exploration mapping and technical assistance; by education of foreigners in French educational institutions; and by providing easy credit terms for purchase of French know-how and equipment. Both BRGM and private companies act as instruments of this policy.

In 1975, a start was also made on a minerals stockpile. A provision was inserted in the budget to provide 250 million francs (about US$50 million) to provide an average of a 2-month supply to supplement industrial stocks. No details of actual stockpile materials were released, but it was reported that most important were silver, platinum, diamonds, phosphate, zirconium, titanium, and cobalt.

In 1980, the Caisse Francaise des Matieres Premieres (CFMP) was constituted to finance a national precautionary stockpile (stock national de precaution). About 1.6

billion francs were to be spent by the end of 1981. The CFMP retains control, but financing comes from the existing Caisse Nationale de l'Energie, and physical management of the stockpile is by the Groupement d' Importation des Metaux, an industry association.

It is important to note that the French stockpile is conceived primarily as a peacetime instrument, to ensure continuous supplies at regular prices to French consumers. It is of course intended as a defense stockpile in wartime.

Principal events in the mineral industry during 1980 included the discovery of two possible antimony deposits, the preparation for opening a small antimony mine in Finisterre, the discovery of a deposit of complex sulfide ores in Morbihan, the commissioning of two oxygen converter plants by Usinor, the beginning of tungsten and tin production in the Ille-et-Vilaine, and the startup of a new plant for beneficiation of andalusite in Glomel.

PRODUCTION

Table 1 shows the latest figures on French mineral production. Both private companies and the Government, through state-owned corporations, produced minerals at home and abroad. BRGM was an important instrument of the Government in ensuring raw materials for the French economy by exploration and ventures abroad.

Table 1.—France: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite, gross weight ____ thousand tons	2,330	2,059	1,978	1,970	1,892
Alumina:					
Crude ____ do	1,184	1,242	1,221	1,238	1,339
Calcined ____ do	1,020	1,081	1,056	1,069	1,173
Metal:					
Primary ____ do	385	r399	391	395	432
Secondary ____ do	133	r143	155	161	170
Antimony metal, smelter	4,500	4,562	5,162	5,631	e5,700
Arsenic, white	7,278	6,043	r e5,950	r e5,550	e5,300
Bismuth:[2]					
Ore and concentrate, metal content kilograms	100,000	73,000	90,000	e45,000	e48,000
Metal ____ do	63,000	52,000	(3)	(3)	--
Cadmium metal	532	790	694	689	791
Chromium metal	847	NA	NA	NA	NA
Cobalt metal (including powder)	793	852	905	771	e900
Copper:					
Mine output, metal content	r188	r128	600	400	500
Metal:					
Blister, secondary	2,200	5,300	3,200	5,000	7,300
Refined:					
Primary	19,296	22,337	20,672	22,000	23,000
Secondary	20,032	22,708	20,628	23,350	23,300
Total	39,328	45,045	41,300	45,350	46,300
Gold mine output, metal content troy ounces	61,022	50,444	59,640	54,109	e50,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight ____ thousand tons	45,181	36,630	33,454	31,627	28,980
Metal content ____ do	13,792	11,050	10,310	9,800	9,063
Metal:					
Pig iron ____ do	18,657	17,884	18,100	18,966	18,670
Ferroalloys:					
Blast furnace: Spiegeleisen and ferromanganese ____ do	367	373	397	449	480
Electric furnace:					
Ferromanganese ____ do	12	21	19	13	20
Ferrosilicon ____ do	237	241	199	272	257
Silicon metal ____ do	41	43	42	55	e45
Ferrochrome ____ do	101	r101	93	95	87
Other ____ do	r113	r127	130	143	123
Total[4] ____ do	r871	r906	880	1,027	1,012

See footnotes at end of table.

Table 1.—France: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Steel ingots and castings thousand tons	23,221	22,094	22,841	23,360	23,116
Semimanufactures do	r23,232	r22,097	22,841	23,360	20,998
Lead:					
Mine output, metal content	r30,738	r31,481	32,500	29,467	28,800
Metal, refined:					
Primary	r118,410	r126,150	125,890	129,050	126,822
Secondary	17,400	18,320	25,450	30,800	34,228
Antimonial lead (Pb content)	52,900	56,930	79,200	84,200	72,936
Total	r188,710	r201,400	230,540	244,050	233,986
Magnesium metal including secondary	r8,035	r8,682	8,500	9,040	9,300
Nickel metal, Ni content of metallurgical products (pure nickel, ferronickel, nickel oxide)	12,313	10,279	7,750	3,320	9,800
Silver:					
Mine output, metal content thousand troy ounces	r2,721	3,004	2,755	2,408	2,373
Metal, Ag content of final smelter products do	3,677	7,060	6,665	7,428	e7,400
Tin, smelter output of solder and other alloys, secondary	11,095	9,500	9,000	9,110	e9,200
Tungsten concentrate, metal content	633	653	608	590	e600
Uranium:					
Mine output, metal content	r2,207	r2,472	2,574	2,771	2,900
Chemical concentrate, U_3O_8 equivalent	r2,926	r3,225	2,921	e3,000	e3,200
Zinc:					
Mine output, metal content	34,700	r41,828	39,900	36,600	36,812
Metal, including secondary:					
Slab	233,254	238,273	231,212	248,977	252,778
Dust	7,460	9,790	8,500	9,043	e10,000
NONMETALS					
Barite	150,000	r211,090	225,000	170,000	e200,000
Bromine, elemental	15,180	15,570	16,200	19,000	e20,000
Cement, hydraulic thousand tons	29,394	28,830	28,025	28,825	29,104
Clays:					
Bentonite[5]	17,297	8,063	e8,000	e9,000	e10,000
Brick and tile clay thousand tons	9,790	9,579	e10,000	NA	NA
Ceramic and potter's clay do	655	681	e700	NA	NA
Clay and marl for cement manufacture do	12,538	14,065	e13,000	NA	NA
Kaolin and kaolinitic clay (marketable) do	274	r294	265	315	e320
Refractory clay, unspecified	848,620	958,936	e900,000	NA	NA
Diatomite	210,255	205,534	e200,000	e200,000	e220,000
Feldspar, crude	188,000	r205,244	e190,000	190,000	e200,000
Fluorspar:					
Crude	r674,663	r630,603	529,600	e530,000	e530,000
Marketable, all grades[e]	306,000	r286,000	304,000	291,000	290,000
Gypsum and anhydrite, crude thousand tons	6,630	r6,700	6,071	6,240	e6,000
Kyanite, andalusite, and related materials	18,131	26,834	e30,000	e30,000	e30,000
Lime: Quicklime, hydrated lime, and dead-burned dolomite thousand tons	4,648	4,468	e4,600	3,870	4,000
Mica[e]	6,500	7,000	7,300	7,000	7,000
Nitrogen: N content of ammonia thousand tons	1,781	2,034	2,020	2,150	2,085
Pigments, mineral, natural: Iron oxides	11,024	15,902	r e16,000	r e16,500	e16,000
Phosphates:					
Phosphate rock (phosphatic chalk)	28,250	19,340	24,580	12,420	e10,000
Thomas slag thousand tons	2,298	1,990	2,042	2,072	1,865
Potash:					
Gross weight (run-of-mine) do	10,272	10,593	11,666	12,514	12,117
K_2O equivalent (run-of-mine) do	1,738	1,719	1,928	2,075	2,039
K_2O equivalent (marketable) do	r1,603	1,580	1,795	1,850	NA
Pozzolan and lapilli	638,000	r895,713	e588,000	e590,000	e600,000
Quartz[6]	462,823	934,032	NA	NA	NA
Salt:					
Rock salt thousand tons	r276	287	458	572	300
Brine salt (refined) do	r1,013	1,016	1,102	1,188	1,113
Marine salt do	r1,323	r986	864	1,802	e1,300
Salt in solution do	r3,278	r3,487	3,859	4,495	4,415
Total do	r5,890	r5,776	6,283	8,057	7,128

See footnotes at end of table.

Table 1.—France: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sodium compounds:					
Sodium sulfate thousand tons	130	119	125	152	e150
Sodium carbonate do	1,316	r1,365	1,353	1,550	e1,600
Stone, sand and gravel:					
Building stone:					
Granite and similar stone do	936	757	NA	NA	NA
Limestone do	819	1,041	NA	NA	NA
Marble do	214	166	NA	NA	NA
Crushed limestone and granite do	6	11	NA	NA	NA
Dolomite:					
For agriculture	413,001	553,150	NA	NA	NA
Crude, for calcining	352,257	365,528	NA	NA	NA
Other	253,637	322,179	NA	NA	NA
Total	1,018,895	1,240,857	NA	NA	NA
Limestone, agricultural and industrial:					
For agriculture thousand tons	926	824	NA	NA	NA
For iron and steel manufacture do	3,573	3,089	NA	NA	NA
For lime and cement manufacture do	25,617	26,957	NA	NA	NA
For sugar mills do	847	1,216	NA	NA	NA
Total do	30,963	32,086	NA	NA	NA
Roadbuilding, foundation, and ballast material (except alluvial sand and gravel):					
Ballast and road surfacing do	140,618	119,663	NA	NA	NA
Foundation material do	6,121	9,259	NA	NA	NA
Ground rock for road filler do	413	10	NA	NA	NA
Paving block and curbing do	81	111	NA	NA	NA
Slate:					
Roof do	129	115	NA	NA	NA
Other do	33	38	NA	NA	NA
Other stone:					
Beach pebble do	103	228	NA	NA	NA
Marl for agriculture do	287	394	NA	NA	NA
Mine fill do	8,295	23,212	NA	NA	NA
Sand and gravel:					
Industrial sands:					
Foundry do	1,090	1,546	NA	NA	NA
Glass sand do	6,336	3,369	NA	NA	NA
Miscellaneous do	1,456	1,109	NA	NA	NA
Other sand and gravel:					
Alluvial do	259,208	r238,270	206,200	200,000	NA
Product of grinding and crushing do	12,895	7,115	NA	NA	NA
Sulfur, byproduct:					
Of natural gas do	1,737	r1,872	1,856	1,968	1,841
Of petroleum do	88	r146	161	184	222
Of unspecified sources do	143	e160	e160	e160	e150
Total do	1,968	r2,178	2,177	2,312	2,213
Talc:					
Crude	246,300	299,500	270,820	268,350	e272,000
Powder	255,800	286,500	292,700	302,470	301,078
MINERAL FUELS AND RELATED MATERIALS					
Asphaltic material[7]	94,180	82,270	68,990	51,420	NA
Carbon black[e]	170,000	170,000	170,000	180,000	170,000
Coal, including briquets:					
Anthracite thousand tons	4,811	4,188	3,871	3,020	18,136
Bituminous coal do	17,068	17,106	15,819	15,597	
Lignite do	3,188	3,080	2,732	2,448	2,586
Total do	25,067	24,374	22,422	21,065	20,722
Briquets do	2,516	2,222	2,175	2,134	e2,100
Coke, metallurgical do	11,312	10,770	10,682	11,615	e11,600
Gas, natural:					
Gross million cubic feet	369,354	393,368	398,517	392,499	382,820
Marketed do	250,450	271,745	277,741	273,687	265,922

See footnotes at end of table.

Table 1.—France: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Natural gas liquids:					
Natural gasoline and condensate thousand 42-gallon barrels	3,956	4,215	4,194	3,981	NA
Propane do	1,608	1,717	1,751	1,669	NA
Butane do	1,781	2,008	1,804	1,790	NA
Total do	7,345	7,940	7,749	7,440	7,394
Peat thousand tons	142	185	[e]140	[e]140	[e]140
Petroleum:					
Crude thousand 42-gallon barrels	[r]7,702	7,557	8,140	8,715	10,304
Refinery products:					
Gasoline:					
Aviation do	335	258	436	348	264
Motor do	152,527	149,728	153,842	161,670	157,485
Jet fuel do	28,099	28,591	32,832	35,192	36,667
Kerosine do	866	770	705	884	1,054
Distillate fuel oil do	309,401	303,920	302,436	326,710	267,655
Residual fuel oil do	243,617	240,783	239,820	246,540	215,723
Lubricants do	8,909	9,364	10,276	10,427	10,860
Other:					
Liquefied petroleum gas do	33,811	34,785	33,860	33,489	36,048
Bitumen do	21,743	20,268	19,956	20,150	19,453
Unspecified do	49,096	32,348	82,755	[e]87,950	[e]79,250
Refinery fuel and losses do	53,793	52,689	50,771	54,691	56,832
Total do	902,197	873,504	927,689	978,051	881,291

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Oct. 5, 1981.

[2]Although output reported is at the smelter stage of production rather than at the mine stage and thus could include metal contained in ores mined in other countries, it is believed that any such production derived from ores from other countries is not duplicative to any significant extent of mine production reported for other countries.

[3]Revised to none.

[4]Series revised to include blast furnace ferroalloys and silicon metal, both hitherto counted separately.

[5]Includes smectic clay.

[6]Includes material for both the glass industry and the ceramics industry.

[7]Excludes bituminous material produced by oil refineries.

TRADE

Tables 2 and 3 show details on foreign trade in minerals of France.

Table 2.—France: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	17,437	12,471	NA	Sweden 8,069; West Germany 1,026.
Oxide and hydroxide	[r]303,031	326,901	12,093	Netherlands 85,473; Spain 83,478; Norway 82,989.
Metal including alloys:				
Scrap	33,967	39,790	NA	Italy 16,797; West Germany 13,876; Belgium-Luxembourg 7,141.
Unwrought	166,418	157,598	NA	Italy 40,133; West Germany 35,126; Belgium-Luxembourg 25,670.
Semimanufactures	217,291	260,798	12,822	West Germany 76,398; Italy 23,525; United Kingdom 21,275.
Antimony:				
Ore and concentrate	7	770	--	Belgium-Luxembourg 365; Czechoslovakia 290; Spain 115.
Metal including alloys, all forms	392	126	NA	Belgium-Luxembourg 47; Italy 30; West Germany 18.
Arsenic metal including alloys, all forms	146	41	NA	NA.
Beryllium metal including alloys, all forms value, thousands	$41	$22	NA	NA.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Bismuth metal including alloys, all forms	7	49	NA	Netherlands 32; United Kingdom 5.
Cadmium metal including alloys, all forms	219	478	92	Belgium-Luxembourg 158; West Germany 144; Netherlands 54.
Chromium:				
Chromite	983	1,379	NA	Italy 793; West Germany 340.
Oxide and hydroxide	171	280	NA	Italy 123; Belgium-Luxembourg 47; West Germany 33.
Metal including alloys, all forms	611	720	245	West Germany 155; Italy 74; Sweden 74.
Cobalt:				
Oxide and hydroxide	192	118	NA	West Germany 40; United Kingdom 35; Belgium-Luxembourg 19.
Metal including alloys, all forms	1,100	797	272	West Germany 186; Italy 83; United Kingdom 56.
Columbium and tantalum:				
Ore and concentrate	--	12	NA	NA.
Metals including alloys, all forms:				
Columbium value, thousands	$14	$21	NA	NA.
Tantalum	12	22	5	West Germany 7.
Copper:				
Ore and concentrate	(1)	564	NA	Spain 346; West Germany 217.
Matte	504	1,181	NA	Spain 978; Belgium-Luxembourg 159.
Sulfate	11,245	12,549	NA	West Germany 5,062; Netherlands 1,460; United Kingdom 1,159.
Metal including alloys:				
Scrap	r98,204	104,933	226	West Germany 45,884; Belgium-Luxembourg 23,345; Italy 21,415.
Unwrought:				
Blister and other unrefined	3,665	5,790	NA	Belgium-Luxembourg 3,990; West Germany 1,775.
Refined	21,249	21,756	733	Italy 7,325; Belgium-Luxembourg 5,070; West Germany 3,469.
Masteralloys	342	257	NA	Italy 79; West Germany 54; Spain 17.
Semimanufactures	117,679	161,090	9,505	West Germany 43,380; Italy 34,708; United Kingdom 20,552.
Gold:				
Ash and sweepings value, thousands	$54,128	$43,910	NA	Spain $42,719; Switzerland $398.
Metal including alloys, unwrought and partly wrought:				
Of domestic origin troy ounces	r733,454	1,080,553	NA	Belgium-Luxembourg 427,283; French Polynesia 287,299.
Temporary imports do.	158,117	171,556	--	Algeria 51,666; Netherlands 46,811; Switzerland 31,990.
Iron and steel:				
Ore and concentrate thousand tons	11,371	10,220	NA	Belgium-Luxembourg 8,328; West Germany 1,890.
Metal:				
Scrap do.	3,662	3,526	2	Italy 2,722; Spain 410; Belgium-Luxembourg 193.
Pig iron including cast iron[2] do.	128	362	26	Italy 158; Belgium-Luxembourg 60; Romania 49.
Sponge iron, powder, shot do.	36	40	NA	West Germany 17; Italy 9.
Ferroalloys do.	501	602	198	West Germany 140; Italy 89; Belgium-Luxembourg 59.
Steel, primary forms do.	2,200	2,333	551	Italy 672; West Germany 154; Greece 126.
Semimanufactures:				
Bars, rods, angles, shapes, sections do.	2,327	2,359	209	West Germany 434; Belgium-Luxembourg 279; China, mainland 187.
Universals, plates, sheets do.	3,486	3,134	311	West Germany 570; Italy 467; Belgium-Luxembourg 141.
Hoop and strip do.	449	452	4	West Germany 154; Belgium-Luxembourg 82; Italy 61.
Rails and accessories do.	231	254	15	Italy 58; Belgium Luxembourg 33; Netherlands 20.
Wire do.	154	164	40	West Germany 33; Belgium-Luxembourg 13; Italy 8.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Tubes, pipes, fittings thousand tons	1,366	1,512	12	U.S.S.R. 273; West Germany 208; Italy 101.
Castings and forgings, rough do	60	70	2	Belgium-Luxembourg 21; West Germany 21.
Lead:				
Ore and concentrate	40	34	NA	NA.
Oxide and hydroxide	13,769	14,270	NA	Romania 2,860; Czechoslovakia 2,317; West Germany 2,163.
Metal including alloys:				
Scrap	32,661	30,191	--	Italy 22,076; West Germany 6,636.
Unwrought	53,425	58,527	1,000	U.S.S.R. 17,829; Belgium-Luxembourg 15,905; West Germany 10,065.
Semimanufactures	1,957	3,700	NA	Algeria 879; West Germany 535; Netherlands 529.
Magnesium metal including alloys:				
Scrap	639	516	128	Italy 201; Netherlands 92.
Unwrought	5,110	4,607	NA	West Germany 2,288; Greece 391; Netherlands 385.
Semimanufactures	117	146	NA	West Germany 80.
Manganese:				
Ore and concentrate	5,606	7,092	NA	Italy 2,777; Netherlands 1,334; Yugoslavia 666.
Oxide	3,660	855	NA	Upper Volta 415; United Kingdom 135.
Metal including alloys, all forms	2,138	2,325	NA	Italy 1,719; West Germany 298; Sweden 181.
Mercury 76-pound flasks	3,539	3,829	NA	Netherlands 1,508.
Molybdenum:				
Ore and concentrate	336	395	--	Belgium-Luxembourg 167; Italy 164.
Oxide	34	22	--	Netherlands 12; Republic of South Africa 10.
Metal including alloys, all forms	136	166	20	West Germany 66; United Kingdom 27.
Nickel:				
Ore and concentrate	--	79	NA	NA.
Matte, speiss, similar materials	850	2,754	--	Finland 2,145; Norway 447; East Germany 141.
Oxide and hydroxide	521	1,033	221	West Germany 87; Belgium-Luxembourg 86; United Kingdom 83.
Metal including alloys:				
Scrap	r2,454	2,708	299	West Germany 1,248; United Kingdom 341; Belgium-Luxembourg 274.
Unwrought	r5,860	5,178	27	West Germany 2,641; Romania 430; Italy 361.
Semimanufactures	r6,537	5,691	706	West Germany 2,772; Libya 329; United Kingdom 216.
Platinum-group metals:				
Waste and sweepings value, thousands	$4,009	$4,508	--	Spain $3,680; United Kingdom $352; Belgium-Luxembourg $174.
Metals including alloys, unwrought and partly wrought troy ounces	245,309	699,889	6,173	Spain 67,709; Netherlands 31,250; Switzerland 19,580.
Selenium, elemental	3	21	NA	NA.
Silver:				
Waste and sweepings value, thousands	$13,564	$21,370	--	Spain $12,224; Sweden $7,931; West Germany $810.
Metal including alloys, unwrought and partly wrought thousand troy ounces	14,860	13,759	NA	United Kingdom 3,031; Netherlands 2,542; Switzerland 2,519.
Tellurium, elemental	5	12	NA	NA.
Thoria	448	--		

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Tin:				
Ore and concentrate	10	7	NA	NA.
Oxide	20	29	NA	West Germany 23.
Metal including alloys:				
Scrap	717	881	NA	Netherlands 684; United Kingdom 169.
Unwrought	868	666	NA	Netherlands 488; Italy 33; United Kingdom 30.
Semimanufactures	598	350	NA	Italy 97; United Kingdom 42.
Titanium:				
Ore and concentrate	331	715	NA	Algeria 360; Guinea 130.
Oxide	13,336	2,262	--	Netherlands 587; Turkey 479; Italy 358.
Metal including alloys, all forms	530	604	22	United Kingdom 254; Italy 174; West Germany 78.
Tungsten:				
Ore and concentrate	1,613	1,082	408	West Germany 382; Austria 179; United Kingdom 108.
Oxide	2	8	NA	Spain 4.
Metal including alloys, all forms	297	363	104	Belgium-Luxembourg 68; West Germany 63.
Uranium:				
Ore and concentrate	194	21	NA	NA.
Metal including alloys, all forms	11,785	7,127	2,771	U.S.S.R. 3,331; United Kingdom 792.
Zinc:				
Ore and concentrate	54,588	46,530	--	Belgium-Luxembourg 31,795; Italy 14,735.
Matte	2,178	1,484	NA	Belgium-Luxembourg 447; West Germany 378; Italy 257.
Metal including alloys:				
Scrap	1,786	4,280	NA	Belgium-Luxembourg 2,524; Italy 1,297.
Blue powder	1,648	1,748	NA	West Germany 940; Switzerland 174; Austria 143.
Unwrought	56,230	47,486	12,635	West Germany 8,766; U.S.S.R. 4,499; Sweden 3,262.
Semimanufactures	42,515	41,041	NA	Belgium-Luxembourg 19,827; West Germany 13,898.
Zirconium:				
Ore and concentrate	742	326	NA	NA.
Metal including alloys, all forms	584	940	575	Sweden 152; West Germany 87; Japan 40.
Other:				
Ores and concentrates	107	55	NA	NA.
Ash and residue containing nonferrous metals:				
Aluminum	9,227	11,569	--	Italy 7,557; West Germany 2,831; Belgium-Luxembourg 1,092.
Copper	20,292	14,691	--	Sweden 4,240; Spain 4,206; Belgium-Luxembourg 3,847.
Lead	3,807	13,062	NA	Belgium-Luxembourg 8,597; West Germany 3,744.
Nickel	1,313	3,723	--	Canada 2,860; Italy 315; West Germany 267.
Zinc	46,795	30,521	NA	Belgium-Luxembourg 24,654; Sweden 3,718; West Germany 2,113.
Unspecified	7,404	19,417	92	West Germany 7,621; Sweden 6,723; Italy 2,849.
Oxides, hydroxides, peroxides	r5,798	5,741	1,613	West Germany 1,949.
Metals including alloys, all forms	r1,848	2,637	4	Switzerland 1,065; West Germany 633; Romania 264.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	1,092	17,908	NA	Ivory Coast 16,653; West Germany 466.
Dust and powder of precious and semiprecious stones	75,006	522	6	NA.
Grinding and polishing wheels and stones	4,326	4,218	44	West Germany 855; Spain 426; Belgium-Luxembourg 314.
Asbestos, crude	532	1,348	NA	Tunisia 1,136.
Barite and witherite	116,535	121,722	NA	West Germany 93,760; Netherlands 14,155; Italy 5,542.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Boron materials:				
Crude natural borates	2,943	10,030	NA	Belgium-Luxembourg 4,672; Italy 3,049; Spain 2,055.
Oxide and acid	30,057	34,479	622	West Germany 10,297; United Kingdom 6,111; East Germany 4,673.
Cement thousand tons	3,365	3,525	332	Ivory Coast 667; Cameroon 374; Venezuela 291.
Chalk	493,467	516,187	4,847	West Germany 213,313; Belgium-Luxembourg 95,158; Netherlands 44,187.
Clays and clay products:				
Crude clays:				
Bentonite	10,371	5,887	--	Belgium-Luxembourg 1,535; Congo 1,135; West Germany 619.
Kaolin	121,325	154,671	--	West Germany 70,331; Italy 45,804; Netherlands 10,674.
Kyanite and sillimanite	2,090	173	--	NA.
Other	499,846	593,404	NA	Italy 272,984; West Germany 151,707; Poland 36,095.
Products:				
Refractory including nonclay brick	r208,181	219,448	3,207	West Germany 46,851; Belgium-Luxembourg 27,177; Italy 24,083.
Nonrefractory	r372,251	435,635	775	West Germany 228,875; Belgium-Luxembourg 109,245.
Cryolite and chiolite	41	105	NA	Guinea 56.
Diamond:				
Gem, not set or strung carats	65,632	37,166	3,055	Switzerland 12,869; Belgium-Luxembourg 12,293.
Industrial do	148,426	191,048	6,875	Belgium-Luxembourg 85,723; Ireland 51,775; Netherlands 19,985.
Diatomite and other infusorial earth	24,982	28,876	--	West Germany 8,134; Belgium-Luxembourg 6,482; Spain 3,055.
Feldspar	52,453	51,726	NA	Belgium-Luxembourg 27,780; Spain 12,195; West Germany 3,776.
Fertilizer materials:				
Crude:				
Nitrogenous	1	25	NA	NA.
Phosphatic	16,503	26,017	NA	United Kingdom 15,278; Ireland 5,193; Belgium-Luxembourg 4,247.
Potassic	11,533	18,453	NA	Belgium-Luxembourg 16,468.
Other including mixed	23,452	24,820	NA	Switzerland 13,783; Belgium-Luxembourg 3,293; Spain 2,246.
Manufactured:				
Nitrogenous	570,360	623,471	NA	Belgium-Luxembourg 119,875; India 87,613; China, mainland 75,543.
Phosphatic:				
Basic slag	161,085	179,789	NA	Switzerland 89,716; Austria 47,154; Italy 38,677.
Other	20,709	33,472	NA	United Kingdom 6,732; Switzerland 4,185; Spain 4,150.
Potassic	523,302	446,757	NA	Belgium-Luxembourg 111,912; Italy 93,081; West Germany 83,828.
Ammonia	72,241	156,072	NA	West Germany 93,055; Spain 27,382.
Fluorspar	95,284	98,742	NA	West Germany 63,114; Italy 9,475; Belgium-Luxembourg 6,708.
Graphite	1,051	1,518	NA	West Germany 654; Spain 166; Morocco 119.
Gypsum and plasters thousand tons	1,009	1,139	NA	Belgium-Luxembourg 346; West Germany 328; Netherlands 142.
Iodine	97	131	--	West Germany 58; Czechoslovakia 24; Switzerland 15.
Lime	271,083	279,654	NA	West Germany 127,132; Belgium-Luxembourg 118,312.
Magnesite	8,185	5,923	NA	West Germany 1,287; Italy 998; Sweden 614.
Mica:				
Crude including splittings and waste	3,120	3,284	NA	United Kingdom 1,434; West Germany 521; Belgium-Luxembourg 326.
Worked including agglomerated splittings	896	940	NA	Switzerland 313; West Germany 297.
Pigments, mineral: Processed iron oxides	9,521	7,537	NA	West Germany 1,442; Italy 1,354; United Kingdom 1,237.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Precious and semiprecious stones except diamond:				
Natural ____ value, thousands__	$19,860	$26,963	$758	Switzerland $17,503; United Kingdom $2,218.
Manufactured _____do____	$11,043	$13,094	$1,402	Switzerland $7,809; Mexico $582; U.S.S.R. $509.
Pyrite (gross weight)_____	87	36	NA	NA.
Salt and brines _____	167,728	230,393	NA	West Germany 149,488; Belgium-Luxembourg 32,465.
Sodium and potassium compounds, n.e.s.:				
Caustic soda_____	52,564	82,202	NA	Egypt 9,546; Indonesia 8,950; Tunisia 8,605.
Caustic potash, sodic and potassic peroxides _____	r11,022	15,121	NA	Netherlands 5,093; Switzerland 1,911.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous _____	17,996	18,479	NA	Belgium-Luxembourg 5,120; Switzerland 4,580; West Germany 3,735.
Slate_____	51,926	66,157	NA	Netherlands 30,929; West Germany 16,461; Belgium-Luxembourg 12,350.
Other _____	58,808	58,093	NA	Belgium-Luxembourg 41,092; West Germany 4,330; Switzerland 3,574.
Worked:				
Slate_____	5,105	5,417	NA	Belgium-Luxembourg 1,873; United Kingdom 1,345; West Germany 1,287.
Paving stone and flagstone__	7,443	11,612	NA	Belgium-Luxembourg 5,910; West Germany 3,267.
Other _____	30,938	34,938	276	Belgium-Luxembourg 12,814; West Germany 11,504; Saudi Arabia 4,165.
Dolomite, chiefly refractory grade __	51,755	51,512	NA	Belgium-Luxembourg 13,693; West Germany 9,750; Switzerland 6,407.
Gravel and crushed rock thousand tons__	10,624	10,912	5	West Germany 7,450; Switzerland 1,279; Belgium-Luxembourg 1,057.
Limestone except dimension _____	157,068	208,036	NA	West Germany 163,656; Belgium-Luxembourg 41,295.
Quartz and quartzite_____	2,308	1,536	NA	United Kingdom 280; West Germany 204.
Sand, excluding metal-bearing thousand tons__	4,342	4,596	NA	West Germany 2,555; Switzerland 931; Italy 792.
Sulfur:				
Elemental, all forms_____do____	1,159	1,249	NA	United Kingdom 369; Tunisia 168; Netherlands 160.
Sulfuric acid, oleum _____	139,057	213,517	NA	Belgium-Luxembourg 116,646; Spain 38,805; West Germany 22,161.
Talc, steatite, soapstone, pyrophyllite __	77,310	75,159	3,601	West Germay 26,178; United Kingdom 9,218; Belgium-Luxembourg 7,864.
Other:				
Crude_____ thousand tons__	1,255	1,206	NA	Belgium-Luxembourg 1,023; Switzerland 165.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture thousand tons__	2,383	2,408	15	West Germany 1,103; Belgium-Luxembourg 957; Netherlands 272.
Unspecified _____	253,859	309,427	NA	Mainly to West Germany.
Oxides, hydroxides, peroxides of strontium, magnesium, barium _____	4,978	9,426	3,319	U.S.S.R. 3,571; West Germany 1,062.
Fluorine, elemental _____	1	25	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals_____	126,366	139,173	870	West Germany 28,939; Netherlands 16,624; Italy 16,055.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural _____	10,379	7,248	NA	United Kingdom 4,500; Morocco 384; Comoros 340.
Carbon black and gas carbon:				
Carbon black _____	56,246	72,664	NA	West Germany 21,676; Italy 17,616; Spain 12,981.
Gas carbon _____	--	1	NA	NA.

See footnotes at end of table.

Table 2.—France: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal and briquets:				
Anthracite and bituminous coal	531,749	569,554	--	West Germany 323,095; Belgium-Luxembourg 83,831; Norway 60,836.
Briquets of anthracite and bituminous coal	27,786	41,312	--	United Kingdom 36,478; West Germany 2,195; Switzerland 2,022.
Lignite including briquets	6,370	6,908	NA	Mainly to Spain.
Coke and semicoke thousand tons	766	1,570	389	West Germany 290; Romania 238; Belgium-Luxembourg 145.
Gas, hydrocarbon, natural thousand cubic feet	6,250	5,854	NA	Switzerland 3,175; Belgium-Luxembourg 2,649.
Hydrogen, helium, rare gases	3,469	6,205	NA	Italy 4,430; Netherlands 371; Switzerland 364.
Peat including briquets and litter	2,075	2,145	NA	NA.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	194	1	NA	Mainly to Austria.
Refinery products:				
Gasoline[3] do	21,970	25,736	303	Netherlands 6,928; West Germany 4,773; Switzerland 4,176.
Kerosine[4] do	8,151	9,509	148	Switzerland 2,433; Greece 1,075; Denmark 926.
Distillate fuel oil do	35,430	35,683	561	Switzerland 11,730; West Germany 8,451; Greece 3,789.
Residual fuel oil do	26,557	42,243	5,507	United Kingdom 6,188; Italy 5,344; West Germany 5,058.
Lubricants do	r4,424	5,235	124	Belgium-Luxembourg 949; United Kingdom 621; West Germany 535.
Mineral jelly and wax do	738	585	NA	United Kingdom 241; West Germany 164; Netherlands 67.
Liquefied petroleum gas do	6,256	8,745	135	Spain 4,182; West Germany 958; Portugal 760.
Petroleum coke, bitumen, other residues do	2,451	1,962	NA	West Germany 868; Switzerland 678; Belgium-Luxembourg 271.
Bituminous mixtures do	335	337	NA	Algeria 141; Belgium-Luxembourg 56; Sweden 37.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	194,478	375,952	NA	West Germany 136,243; Netherlands 106,240; Italy 61,156.

rRevised. NA Not available.
[1]Value only reported at $6,000.
[2]Includes spiegeleisen.
[3]Includes motor and aviation gasoline, other light oils for similar uses, and white spirit.
[4]Includes other medium oils.

Table 3.—France: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite thousand tons	1,955	1,720	NA	Guinea 1,482; Greece 108; Guyana 48.
Oxide and hydroxide	r55,781	38,187	2,986	West Germany 26,249; Netherlands 5,135.
Metal including alloys:				
Scrap	42,289	52,228	1,654	Belgium-Luxembourg 13,910; West Germany 13,510.
Unwrought	290,827	315,102	7,658	Netherlands 71,012; West Germany 55,461; Norway 35,225.
Semimanufactures	153,503	197,999	8,417	West Germany 71,197; Belgium-Luxembourg 49,548.
Antimony:				
Ore and concentrate	9,984	10,794	NA	Thailand 2,586; Bolivia 2,431; Australia 1,426.
Metal including alloys, all forms	818	886	NA	China, mainland 665; Spain 127.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Arsenic metal including alloys, all forms	60	113	6	Sweden 31; Netherlands 29.
Beryllium metal including alloys, all forms	18	9	8	U.S.S.R. 1.
Bismuth metal including alloys, all forms	346	322	NA	Bolivia 104; Belgium-Luxembourg 79; West Germany 55.
Cadmium metal including alloys, all forms	609	735	NA	Belgium-Luxembourg 193; Netherlands 147; Japan 140.
Chromium:				
Chromite	242,480	261,701	NA	Republic of South Africa 105,781; Turkey 56,750; Madagascar 37,852.
Oxide and hydroxide	5,241	5,821	55	West Germany 2,924; Italy 1,434; United Kingdom 755.
Metal including alloys, all forms	64	246	21	Japan 95; Belgium-Luxembourg 92.
Cobalt:				
Intermediate metallurgical products	9,727	7,684	NA	Mainly from Morocco.
Oxide and hydroxide	293	267	17	Belgium-Luxembourg 229; United Kingdom 12.
Metal including alloys, all forms	994	897	127	Belgium-Luxembourg 325; West Germany 137.
Columbium and tantalum metals including alloys, all forms:				
Columbium	11	5	NA	Mainly from West Germany.
Tantalum	30	52	31	West Germany 11.
Copper:				
Ore and concentrate	1	4	NA	NA.
Matte	522	45	NA	NA.
Sulfate	2,540	2,758	NA	Italy 829; U.S.S.R. 622; Belgium-Luxembourg 539.
Metal including alloys:				
Scrap	r19,086	24,870	89	West Germany 7,412; Belgium-Luxembourg 5,827; United Kingdom 2,603.
Unwrought:				
Blister and other unrefined, unalloyed	22,734	21,258	NA	Zaire 16,431; Belgium-Luxembourg 1,596; Chile 1,351.
Refined, unalloyed	282,691	347,731	14,081	Zambia 107,637; Belgium-Luxembourg 105,884; Chile 41,844.
Master alloys	789	305	NA	Belgium-Luxembourg 149; Spain 107; West Germany 39.
Semimanufactures	213,502	206,220	3,213	Belgium-Luxembourg 110,088; West Germany 39,901; Italy 23,463.
Germanium metal including alloys, all forms, value, thousands	$795	$755	$222	Belgium-Luxembourg $413.
Gold:				
Waste and sweepings, do.	$4,575	$7,454	NA	Switzerland $5,037; United Kingdom $661; West Germany $591.
Metal including alloys, unwrought and partly wrought:				
For domestic use, thousand troy ounces	1,666	2,804	8	West Germany 1,932; Netherlands 328; Italy 248.
Temporary imports, do.	629	591	72	Netherlands 236; Switzerland 176; United Kingdom 53.
Iron and steel:				
Ore and concentrate except roasted pyrite, thousand tons	14,604	17,345	NA	Brazil 4,398; Sweden 3,000; Mauritania 2,868.
Roasted pyrite	92,272	87,452	NA	Italy 56,332; West Germany 18,927; Spain 12,115.
Metal:				
Scrap	393,803	422,289	321	Belgium-Luxembourg 201,389; West Germany 102,894; United Kingdom 55,269.
Pig iron including cast iron[1]	407,438	446,457	NA	West Germany 417,646; Canada 12,608.
Sponge iron, powder, shot	19,335	29,342	5	Sweden 14,649; West Germany 7,770; Venezuela 2,497.
Ferroalloys	178,554	318,117	395	New Caledonia 142,095; Belgium-Luxembourg 38,836.
Steel, primary forms, thousand tons	2,272	2,664	(2)	Belgium-Luxembourg 1,473; West Germany 785; Netherlands 132.
Semimanufactures:				
Bars, rods, angles, shapes, sections, do.	1,871	1,988	(2)	Belgium-Luxembourg 611; West Germany 583; Italy 534.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Universals, plates, sheets thousand tons	2,575	2,861	2	Belgium-Luxembourg 1,408; West Germany 701; Italy 245.
Hoop and strip	321,990	394,854	162	Belgium-Luxembourg 200,279; West Germany 144,631.
Rails and accessories	36,360	36,288	NA	Belgium-Luxembourg 21,147; United Kingdom 10,319.
Wire	117,127	133,050	55	Belgium-Luxembourg 54,459; West Germany 41,970; Italy 16,004.
Tubes, pipes, fittings	486,720	495,970	2,622	West Germany 161,100; Italy 128,021; Spain 49,875.
Castings and forgings, rough	43,191	49,006	16	West Germany 24,158; Italy 10,044; Belgium-Luxembourg 5,571.
Lead:				
Ore and concentrate	134,738	134,824	948	Ireland 44,708; Morocco 26,110; Australia 17,630.
Oxide	841	1,568	NA	Belgium-Luxembourg 637; West Germany 451; Bulgaria 131.
Metal including alloys:				
Scrap	17,246	26,411	NA	Belgium-Luxembourg 17,667; Netherlands 5,494; United Kingdom 1,196.
Unwrought	38,238	51,817	NA	West Germany 14,905; United Kingdom 11,139; Belgium-Luxembourg 9,881.
Semimanufactures	1,234	1,652	62	West Germany 561; Belgium-Luxembourg 470; Spain 450.
Magnesium metal including alloys:				
Scrap	257	450	NA	Italy 192.
Unwrought	3,149	3,851	1,016	Norway 2,219.
Semimanufactures	357	282	30	Italy 124; West Germany 38; Norway 33.
Manganese:				
Ore and concentrate thousand tons	958	1,275	2	Gabon 597; Republic of South Africa 506.
Oxide	5,541	6,679	48	West Germany 2,508; Spain 1,636; Belgium-Luxembourg 1,462.
Metal including alloys, all forms	1,030	3,471	NA	Portugal 1,940; Republic of South Africa 927.
Mercury 76-pound flasks	5,279	4,003	NA	Spain 2,060; China, mainland 812; Algeria 464.
Molybdenum:				
Ore and concentrate	6,963	7,413	2,408	Canada 2,225; Chile 1,138; Netherlands 671.
Oxide	359	119	36	Netherlands 43; Belgium-Luxembourg 17; West Germany 17.
Metal including alloys, all forms	164	206	40	Austria 51; West Germany 44; United Kingdom 32.
Nickel:				
Ore and concentrate	100			
Matte, speiss, similar materials	12,986	10,500	255	New Caledonia 6,184; Canada 1,942; Australia 1,209.
Oxide and hydroxide	226	141	--	Cuba 70; Canada 65.
Metal including alloys:				
Scrap	r719	1,444	--	Italy 697; United Kingdom 317; Netherlands 125.
Unwrought	r14,733	19,838	2,736	West Germany 4,503; Republic of South Africa 2,689; Finland 2,243.
Semimanufactures	r5,359	5,026	988	United Kingdom 1,942; West Germany 1,533.
Platinum-group metals:				
Waste and sweepings value, thousands	$18,600	$24,060	$81	Netherlands $6,836; West Germany $5,246; Yugoslavia $2,719.
Metals including alloys, unwrought and partly wrought troy ounces	358,512	461,652	30,640	Switzerland 154,002; United Kingdom 67,549; West Germany 52,824.
Selenium, elemental	53	62	NA	United Kingdom 21; Japan 19.
Silver:				
Waste and sweepings value, thousands	$6,825	$18,033	$936	Switzerland $10,802; United Kingdom $2,069; Spain $1,042.
Metal including alloys, unwrought and partly wrought thousand troy ounces	43,498	30,322	158	United Kingdom 11,329; Switzerland 4,497; Belgium-Luxembourg 3,151.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tellurium, elemental	12	11	NA	Belgium-Luxembourg 6; United Kingdom 2.
Thorium ore and concentrate	9,053	8,990	NA	Mainly from Australia.
Tin:				
Ore and concentrate	504	941	NA	Mainly from Guyana.
Oxide	376	128	NA	Italy 76; West Germany 39; United Kingdom 13.
Metal including alloys:				
Scrap	136	99	NA	Italy 42; Switzerland 29; Netherlands 24.
Unwrought	10,828	10,565	20	Malaysia 3,647; Thailand 2,450; Indonesia 1,426.
Semimanufactures	r157	134	NA	West Germany 61; Denmark 20; Netherlands 17.
Titanium:				
Ore and concentrate	154,477	129,408	NA	Mainly from Australia.
Oxide	27,190	18,734	3,922	Netherlands 4,357; West Germany 4,314; Belgium-Luxembourg 2,839.
Metal including alloys, all forms	965	1,786	467	Japan 411; United Kingdom 392; West Germany 277.
Tungsten:				
Ore and concentrate	2,468	1,586	--	China, mainland 669; Republic of Korea 248; Portugal 166.
Oxide	34	17	NA	Netherlands 6.
Metal including alloys, all forms	251	307	6	West Germany 116; Austria 57; United Kingdom 27.
Uranium:				
Ore and concentrate	3,131	2,942	NA	Niger 1,955; Gabon 899.
Metal including alloys, all forms	r28	136	126	NA.
Vanadium metal including alloys, all forms	1	19	5	West Germany 14.
Zinc:				
Ore and concentrate	454,582	494,334	15,753	Canada 132,314; Peru 96,114; Ireland 86,946.
Oxide	5,062	8,280	NA	Netherlands 3,397; West Germany 1,873; Belgium-Luxembourg 1,492.
Metal including alloys:				
Scrap	8,028	4,600	NA	Belgium-Luxembourg 1,988; Netherlands 1,055; United Kingdom 629.
Blue powder	3,456	3,412	NA	Belgium-Luxembourg 1,739; Netherlands 769; Spain 706.
Unwrought	99,732	101,253	191	Belgium-Luxembourg 49,295; Netherlands 18,250; West Germany 10,159.
Semimanufactures	5,526	6,521	NA	West Germany 4,431; Belgium-Luxembourg 1,091.
Zirconium:				
Ore and concentrate	38,787	41,904	NA	Australia 38,118; Republic of South Africa 2,861.
Oxide[3]	719	351	99	United Kingdom 202; West Germany 50.
Metal including alloys, all forms	496	985	924	West Germany 43.
Other:				
Ores and concentrates	1,662	8,549	NA	Greece 6,944; Chile 880; Australia 389.
Ash and residue containing nonferrous metals:				
Aluminum	7,138	12,745	176	West Germany 3,806; Italy 3,391; Poland 1,759.
Copper	1,072	1,377	180	Belgium-Luxembourg 841.
Lead	9,712	8,768	NA	Italy 6,407; Belgium-Luxembourg 1,555.
Nickel	40	109	NA	West Germany 63.
Zinc[4]	24,529	34,186	2,115	Belgium-Luxembourg 14,325; West Germany 11,787.
Other	r15,142	38,604	23	Republic of South Africa 23,014; Italy 14,150.
Oxides, hydroxides, peroxides	r3,339	3,344	173	West Germany 939; Finland 444; Republic of South Africa 333.
Metals:				
Metalloids	3,936	4,751	12	Norway 1,378; Spain 1,098; Italy 876.
Alkali, alkaline-earth, rare-earth metals	317	120	NA	United Kingdom 42; Austria 10.
Pyrophoric alloys	43	119	NA	Brazil 75; Austria 22; Japan 21.
Base metals including alloys, all forms	120	6	3	Belgium-Luxembourg 3.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	38,097	27,636	881	Turkey 12,803; West Germany 10,492.
Dust and powder of precious and semi-precious stones	8,345	1,357	1,137	Republic of South Africa 151.
Grinding and polishing wheels and stones	7,231	8,245	111	Italy 2,131; West Germany 1,824; Belgium-Luxembourg 1,564.
Asbestos, crude	110,812	126,476	359	Canada 59,836; U.S.S.R. 24,857; Republic of South Africa 16,328.
Barite and witherite	8,983	14,427	NA	West Germany 7,109; China, mainland 5,825; Romania 1,199.
Boron materials:				
Crude natural borates	181,070	192,823	67,583	Turkey 122,157.
Oxide and acid	8,878	1,379	222	Italy 659; Turkey 218; United Kingdom 175.
Bromine	2,762	2,542	NA	Israel 1,526; United Kingdom 904.
Cement	313,725	332,248	97	Belgium-Luxembourg 276,854; Italy 29,907; West Germany 17,453.
Chalk	35,689	29,057	--	West Germany 24,344; Belgium-Luxembourg 4,566.
Clays and clay products:				
Crude clays:				
Bentonite	87,235	92,464	5,086	Italy 35,330; Greece 30,072; West Germany 13,592.
Kaolin (china clay)	306,755	332,710	47,405	United Kingdom 240,516; West Germany 24,682.
Kyanite and sillimanite	6,196	5,126	1,396	India 1,649; West Germany 811; Republic of South Africa 508.
Other	200,398	209,050	12,487	West Germany 156,923; United Kingdom 28,433.
Products:				
Refractory including nonclay brick	r246,908	233,641	2,761	West Germany 104,307; Belgium-Luxembourg 52,424; Austria 37,044.
Nonrefractory thousand tons	r871	974	NA	Italy 555; West Germany 240; Spain 84.
Cryolite and chiolite	792	766	NA	Mainly from Denmark.
Diamond:				
Gem, not set or strung carats	565,318	456,186	5,522	Belgium-Luxembourg 186,758; Israel 121,788; India 56,559.
Industrial do	675,580	496,826	42,747	Ireland 253,583; Belgium-Luxembourg 62,389; United Kingdom 46,198.
Diatomite and other infusorial earth	8,878	11,327	6,244	West Germany 3,054; Algeria 897; Spain 405.
Feldspar	17,024	17,839	NA	West Germany 11,077; Portugal 4,742.
Fertilizer materials:				
Crude:				
Nitrogenous	9,220	9,693	NA	Mainly from Chile.
Phosphatic thousand tons	4,966	5,386	934	Morocco 2,314; Togo 709; Israel 452.
Other including mixed	23,098	25,480	NA	Netherlands 12,512; Belgium-Luxembourg 4,231; Italy 3,809.
Manufactured:				
Nitrogenous thousand tons	1,105	1,308	220	Belgium-Luxembourg 382; Netherlands 382; West Germany 114.
Phosphatic:				
Basic slag	498,286	677,117	NA	Belgium-Luxembourg 657,030; West Germany 20,037.
Other	599,811	585,226	187,030	Tunisia 123,473; Netherlands 122,120; Belgium-Luxembourg 81,734.
Potassic	322,242	363,618	NA	Belgium-Luxembourg 154,314; Israel 112,109; East Germany 34,904.
Ammonia	284,060	354,218	31,692	Belgium-Luxembourg 88,214; Netherlands 55,250; West Germany 53,107.
Fluorspar	1,796	1,228	NA	Italy 461.
Graphite, natural	6,781	7,744	12	Italy 2,647; Madagascar 1,451; China, mainland 1,442.
Gypsum and plasters thousand tons	16,900	13,297	NA	Spain 5,587; West Germany 4,472.
Iodine	998	1,156	34	Japan 721; Chile 371.
Lime	86,870	131,629	NA	Belgium-Luxembourg 65,776; West Germany 62,958.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Magnesite	92,239	98,358	933	Greece 36,604; Spain 12,972; Austria 9,979.
Mica:				
Crude including splittings and waste	10,164	3,418	349	India 998; Brazil 845; Morocco 700.
Worked including agglomerated splittings	224	138	NA	Belgium-Luxembourg 54; Switzerland 34; India 15.
Pigments, mineral: Processed iron oxides	28,867	32,369	152	West Germany 22,060; Belgium-Luxembourg 7,804.
Precious and semiprecious stones except diamond:				
Natural value, thousands	$97,459	$149,987	$7,191	Switzerland $91,510; Thailand $14,965; India $12,198.
Manufactured do	$2,211	$3,920	$837	Switzerland $1,615; Japan $298; Austria $252.
Pyrite (gross weight)	617	672	NA	Italy 529.
Salt and brines	162,782	187,546	NA	Belgium-Luxembourg 94,771; Netherlands 33,494; Tunisia 21,415.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	136,476	217,454	NA	Belgium-Luxembourg 106,443; West Germany 83,202.
Caustic potash and sodic and potassic peroxides	899	2,121	NA	Spain 774; Yugoslavia 746; West Germany 341.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	87,136	89,372	NA	West Germany 43,854; Italy 34,169.
Slate	6,319	5,225	NA	United Kingdom 2,525; Italy 1,245; Spain 1,171.
Other	161,535	191,513	NA	Republic of South Africa 71,827; Norway 34,210; Finland 32,103.
Worked:				
Slate	127,175	145,271	NA	Mainly from Spain.
Paving and flagstone	33,014	34,399	NA	West Germany 22,804; Italy 9,971.
Other	104,796	109,856	NA	Italy 95,693; Portugal 5,622; West Germany 3,392.
Dolomite, chiefly refractory grade	296,808	389,856	NA	Belgium-Luxembourg 214,643; West Germany 141,891.
Gravel and crushed rock thousand tons	4,697	4,376	NA	Belgium-Luxembourg 3,240; United Kingdom 698; Norway 244.
Limestone except dimension	188,303	176,612	NA	Mainly from Belgium-Luxembourg.
Quartz and quartzite	13,941	23,681	848	Italy 15,746; West Germany 5,771.
Sand, excluding metal-bearing thousand tons	1,231	1,560	NA	Belgium-Luxembourg 880; United Kingdom 468; Netherlands 140.
Sulfur:				
Elemental, all forms	663,716	716,789	137,230	Poland 418,736; Canada 78,853; Mexico 41,701.
Sulfuric acid, oleum	200,272	205,249	NA	Belgium-Luxembourg 103,919; West Germany 98,095.
Talc, steatite, soapstone, pyrophyllite	17,258	18,028	428	Italy 11,114; Belgium-Luxembourg 2,435; Spain 1,305.
Other:				
Crude thousand tons	978	1,122	3	Switzerland 716; Spain 145; Greece 43.
Slag, dross, similar waste, not metal-bearing:				
From iron and steel manufacture	833,921	695,222	NA	Belgium-Luxembourg 450,151; West Germany 94,800; Canada 70,721.
Unspecified	68,444	35,990	NA	West Germany 21,145; Belgium-Luxembourg 5,617; Italy 3,854.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	1,416	1,436	103	West Germany 838; Ireland 145; Japan 98.
Fluorine, elemental	5	3	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	149,551	174,372	*f* 661	Italy 63,824; Belgium-Luxembourg 45,823; West Germany 23,618.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,246	3,614	1,324	NA.
Carbon black	76,566	80,405	3,711	Netherlands 33,988; West Germany 23,558; Italy 10,023.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	23,783	26,708	3,320	Republic of South Africa 7,633; West Germany 6,670; Poland 4,466.
Briquets of anthracite and bituminous coal	268,394	253,264	8,719	West Germany 152,619; Belgium-Luxembourg 55,691; Gabon 29,215.
Lignite including briquets	174,549	191,056	NA	Mainly from West Germany.
Coke and semicoke thousand tons	1,696	2,272	16	West Germany 1,969; Belgium-Luxembourg 157; Netherlands 111.
Gas, natural million cubic feet	544	606	NA	Netherlands 453; Algeria 90; Norway 62.
Hydrogen, helium, rare gases	35,200	31,889	186	Belgium-Luxembourg 24,106; West Germany 4,436; Netherlands 3,078.
Peat including briquets and litter	116,408	131,356	NA	West Germany 74,664; U.S.S.R. 32,001; Netherlands 17,193.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	1,321,015	932,727	NA	Saudi Arabia 331,070; Iraq 179,772; Nigeria 73,883.
Refinery products:				
Gasoline[5] do	19,727	25,966	155	Italy 7,844; West Germany 4,977; U.S.S.R. 1,724.
Kerosine[6] do	362	391	43	Netherlands Antilles 107; Italy 76; Libya 60.
Distillate fuel oil do	23,649	17,064	17	U.S.S.R. 6,240; Italy 3,608; United Kingdom 2,083.
Residual fuel oil do	17,447	36,836	NA	Iran 6,198; Venezuela 4,363; Netherlands 3,912.
Lubricants do	r846	1,328	166	United Kingdom 443; Italy 253; Netherlands 154.
Liquefied petroleum gas do	3,646	5,098	--	Saudi Arabia 1,053; U.S.S.R. 624; United Kingdom 570.
Other:				
Mineral jelly and wax do	141	156	23	Netherlands 46; West Germany 35; Republic of South Africa 16.
Pitch and pitch coke do	708	895	NA	Belgium-Luxembourg 219; U.S.S.R. 214; West Germany 193.
Petroleum coke do	6,862	9,808	8,813	United Kingdom 444; West Germany 414.
Bitumen and other residues do	61	52	NA	Belgium-Luxembourg 28; West Germany 13; Netherlands 9.
Bituminous mixtures do	106	94	3	West Germany 49; Belgium-Luxembourg 32.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	428,074	477,114	280,565	Netherlands 36,746; Italy 34,707; Spain 32,622.

rRevised. NA Not available.
[1]Including spiegeleisen.
[2]Less than 1/2 unit.
[3]Includes oxides of germanium, if any.
[4]Includes matte of zinc.
[5]Includes motor and aviation gasoline, other light oils for similar uses, and white spirit.
[6]Includes other medium oils.

COMMODITY REVIEW

METALS

Aluminum.—Aluminium Pechiney, Union des Bauxites, Société Anonyme des Bauxites et Alumines de Provence, Société Alusuisse France, Etablissement Sabulard, and Etablissement Rondani produced bauxite in France during 1980 from mines located in Var, Herault, Bouches-de Rhone, and Ariege Departments. Roughly two-thirds of French consumption was domestic

bauxite, but the general trend of bauxite production was downward, caused by exhaustion of reserves. About 800 persons were employed in bauxite mines.

Pechiney Ugine Kuhlmann (PUK) produced alumina in three plants in France with a total capacity of 1,390,000 tons per year. The largest, with a capacity of 745,000 tons of alumina per year, was located at Gardanne, Bouches-du-Rhone. Aluminum metal was produced in 10 plants situated in the Alps and Pyrenees; the plant at Nogueres, Pyrenees-Atlantiques was the largest, accounting for about one-third of the total French aluminum output. Approximately 7,000 persons worked in aluminum-producing facilities. France also operated 40 plants with a capacity of 520,000 tons of semimanufactured aluminum products per year. Employment in these plants was 14,000 persons.

Antimony.—During 1980, exploration of the deposit of Ty Gardien at Quimper, Finisterre, confirmed the existence of a small deposit of antimony with reserves of about 2,800 tons of contained metal. Exploitation was planned for 1981 and the deposit should be exhausted by 1983. In addition, indications of possible antimony deposits were discovered at Rosnoen in Finisterre and Coefferies in Ile-et-Vilaine.

Société Industrielle et Chimique de l'Aisne, situated in Chauny and owned by the Hochschild Group, produced antimony chemicals; Société Nouvelle des Mines de la Lucette operated an antimony smelter and a plant for production of antimony chemicals. Both companies operated on imported raw materials.

Copper.—Preliminary results of exploration carried out by the BRGM indicated possible copper, lead, zinc, and silver complex ore deposits at Rosemellec Stival and Telhaie in Morbihan. In addition, metallurgical work continued on samples from the Bodennec and Porte aux Moins deposits of complex lead, zinc, and copper ores.

During 1980, France had only one large 45,000-ton-per-year electrolytic copper plant, situated at Palais, Haute-Vienne, in operation. This plant operated on imported blister or anodes and on scrap. A small refinery was operated by Afficuivre. Afficuivre was acquired by the Compagnie Francaise de Ferrailles during 1980. Furthermore, another plant located near Toulouse and owned by the Affinerie du Sud-Oest was a producer of fire-refined copper.

About 50 plants with an annual capacity of 600,000 tons of copper semimanufactured products, employing 17,000 persons, were in operation during 1980 in France.

Gold.—Exploration for gold continued at Saint Yrieix, Haute Vienne, conducted by the BRGM and Penarroya.

The only producer of gold in France was the Salsigne Mine in the Department of Aude. This mine, owned by Canadian interests, was purchased by Coframines, a subsidiary of the BRGM, at the beginning of 1980.

Iron and Steel.—The iron ore producing sector of France had an uneventful year. East Basin was by far the largest area of iron ore production in the country during 1980.

The steel producing sector, after going through a drastic intervention by the Government during 1979, started to show slight signs of improvement. Two new oxygen converters, 125 tons each, went onstream at the Neuves-Maison steelworks operated by Usinor; another two oxygen converters, 85 tons each, started production at the Rehon steelworks also operated by Usinor. At the Seremange plant owned by Sollac, a new continuous caster was commissioned.

Lead and Zinc.—Possible new lead and zinc deposits were discovered in the complex sulfide mineralization near Rosmellec, Stival, and La Telhaie in Morbihan. The Bodennec and Porte aux Moins deposits were explored and metallurgical research was underway to resolve complex problems faced during flotation of these ores.

In France, lead and zinc ores and lead and zinc concentrates were produced at the Largentiere, Ardeche, and Malines, Gard, Mines, owned by the Société Minière et Metallurgique de Penarroya. In addition, at the La Farges Mine, Correze, owned by the Société Minière de Correze, lead concentrates and barites were produced; at the Noailhac-Saint-Salvy Mine, Tarn, only zinc concentrates were produced and germanium was a byproduct. Primary lead was produced in an Imperial smelter plant at Noyelles-Godault, Pas-de-Calais, with a capacity of 150,000 tons per year of lead; in addition, a lead refinery was part of the operation. Both facilities were part of a metallurgical complex operated by Penarroya.

Primary zinc was produced in three smelters. Compagnie Royale Asturienne des Mines, Asturienne, operated one electrolytic zinc plant located at Auby-les-Douai, Nord, with a capacity of 115,000

tons of zinc per year. A second electrolytic zinc plant was operated by the Société des Mines et Fonderies de Zinc de la Vieille Montagne, at Viviez, Aveyron, with a capacity of 110,000 tons of zinc per year. In addition, Vieille Montagne operated a thermal zinc refinery, with a capacity of 30,000 tons of extra pure zinc, located at Creil, Oise. Imported concentrates for Vieille Montagne were roasted in a roasting plant at Calais, Pas-de-Calais, before being sent to various European smelters. The third French zinc smelter was the Imperial smelter at Noyelles-Godault, Pas-de-Calais, with a capacity of 110,000 tons of zinc per year, operated by Penarroya.

Nickel.—After closure in 1979 because of a fire, the nickel plant located at Sandouville near Le Havre started up again in 1980. The plant capacity was reported at 20,000 tons per year of nickel products, of which 16,000 tons were nickel cathodes (99.98% nickel), as well as about 600 tons of cobalt.

Tungsten.—The Société des Mines de Montbellaux (SMM) started production of tungsten and tin from the Luitre deposit in Ille-et-Vilaine. Reports indicated reserves of 3 million tons of 0.25% WO_3 ore. The Société Industrielle et Chimique de l'Aisne (SICA) owned about three-fourths of SMM, and SICA was controlled by the Panamanian company Corona S.A., reportedly the principal company of the Hochschild Group.

Salau Mine in Ariege, owned by the Société Minière d'Anglade, was the major producer of tungsten in France during 1980.

The significant drop in tungsten production resulted from closure of the Enguiales Mine in Aveyron in the latter part of 1979.

NONMETALS

Andalusite.—During 1980, Demain-Azin-Mineraux (DAM) produced andalusite from its operations at Glomel, Cote-du-Nord, in northern Brittany. The reserves of the deposit were reported at 4 to 5 million tons. A new 25,000-ton-per-year beneficiation plant became fully operational at Glomel during 1980, bringing total plant capacity in the area to 50,000 tons per year.

The mine at Glomel was open cast, with 10- to 15-meter benches. Blasting was necessary. The ore was crushed to minus 1.6 millimeters to plus 0.6 millimeters. An electromagnetic separator removed most of the black chlorite and mica. The andalusite-quartz concentrate was separated into its two components in a double circuit, heavy media separation unit. DAM produced two grades of products that are sold under the commercial name "Kerphalite," named after a local village. Chemical composition of the two products was as follows:

Percent	Kerphalite KA	Kerphalite KB
SiO	37.5 -38.6	44.3 -44.8
Al_2O_3	59.0 -59.5	52.0 -53.0
Fe_2O_3	.9 - 1.1	.9 - 1.1
CaO	.15- .3	.12- .27
MgO	.09- .15	.12- .17
TiO_2	.2 - .28	.25- .31
Na_2O	.08- .10	.15- .25
K_2O	.15- .35	.25- .40

Barite.—During 1980, France remained an important producer of barite. The largest barite producer in the country (about 60% of the total) was the Société Barytine de Chaillac, with mines located about 50 kilometers southwest of Chateauroux in the northern part of the Massif Central. During 1980, the company engaged in research on treatment of tailings aimed at making pellets for use as backfill. During the year, dewatering techniques for this purpose were tested.

At the Lacan Mine, Aveyron, operated by the Société des Produits Chimiques de Viviez, a new access road was completed. Construction of a new plant for gravimetric preconcentration was near completion at yearend, with startup expected early in 1981. In addition to the two companies already mentioned, barite was produced by the following companies: Société des Couleurs Zinciques with mines at Pesseus, near Rodez, Aveyron, in the southern part of the Massif Central; Société Minière de Correz with Farges Mine near the town of Ussel; and Société de Mines de Garrot at Parres, near Les Arcs, Var. Barite was also recovered at the Rossignol fluorspar mine near Chaillac, Indre, operated by the Société Industrielle du Centre, as a byproduct of fluorspar production.

Cement.—About three-fourths of the 40 million tons per year of cement capacity in France was operated by the Société des Ciments Francais (SCF), Ciments Lafarge, France (CLF), and Ciments Vicats. Of the of 20 plants owned by SCF, 3 had a capacity of over 1 million tons: Airvault, 1.12 million tons, in Deux-Sevres Department; Rombas, 1.16 million tons, Moselle Department; and Couvrot 1.6 million tons, Department of the Marne. CLF operated 21 plants, but only 1 at Saint Pierre-la-Cour, Mayenne Department, had a capacity over 1 million tons. Ciment Vicat operated nine plants. Three had capacities over 1 million tons: Grave de

Paille, in Alpes Maritimes Department; Montalieu, at Verieu, Isere; and Xeuille, in Meurth et Moselle Department.

Clays.—Clays for refractories and ceramics were produced in almost all parts of France during 1980. In the Charente Basin, in the Charente Maritime Department in southwestern France, production of chamotte (burnt refractory clay) was dominated by the following companies: Argiles et Mineraux S.A., which operated quarries at Fountbuillant, Grand Liot, and Saint Georges and plants at Clerac and Bernet, all near Montguyon; and by the Société des Argiles Refractaires at Ceramiques d' Aquitaine, which produced clay from a quarry at Condeon in the northern part of the Charente Basin and processed it in a plant near Oriolles. In the Provins Basin, about 80 kilometers southeast of Paris near the town of Provins, DAM was the largest producer of chamottes with eight quarries, two underground mines, and one processing plant. A subsidiary of DAM, Terres Refractaires du Centre, produced clay for sanitary and tile products from the Damperre quarry near Beaulon, Allier. A subsidiary of Watts, Blake, Bearne and Co. Ltd. (WBB) of the United Kingdom, WBB of France produced clay from a property at Tournon-Saint-Martin near Chatelleraux.

Diatomite.—Riom-les Montagnes Mine in Cantal and Saint Bazil Mine in Ardeche operated by the Carbonisation et Charbon Actif S.A. remained principal producers of diatomite in France during 1980. In addition, Johns-Manville Corp. of the United States operated the Murtal Mine, also in Cantal.

Dolomite.—The leading dolomite producers in France were: La Dolomie Francaise S.A., with installations at Neau, near Mayenne, at Voisey in Haute-Marne, and at Ferriere-la-Grande in the north of France; Magnesie et Dolomie de France with mines at Elinghem-Ferques, Pas-de-Calais; Blanc Mineraux de Paris S.A., with a mine at Saint-Martin-Lys, Aude, was the major producer of filler-grade dolomite. Another producer of filler-grade dolomite was the mine at Saint Colombe-sur-Guette operated by Sopramine S.A., a subsidiary of Saint Gobin S.A. Société d' Exploitation de Sables et Mineraux S.A. produced dolomite at Chanac, Lozer, and Septemes in Bouche du Rhone, largely for production of glass. In addition, Chaux et Dolomies du Boulonnais S.A. produced calcined dolomite at Locquinghem-Rety. Crude dolomite for sale was produced by Randin S.A. at Elinghem-Ferques, Carrieres du Basin de Sambre at Dourlers, and Ara et Co. at Asap-Arros.

Fluorspar.—During 1980, France was an important producer and a net exporter of fluorspar, although imports of acidspar from South Africa in 1980 increased four times compared with 1979 imports.

The French fluorspar production was dominated by subsidiaries of PUK. The Société d' Enterprises, Carrieres et Mines de l'Esterel (SECME) completed deepening the main shaft at its mine at Fontsante, Var, in the first half of the year and managed to produce over 100,000 tons of acidspar during the year in review. At the Fontsante Mine sellaite (MgF_2) was produced and used for use in PUK's hydrofluoric acid plant near Lyon. The Fontsante Mine was the only mine operated by SECME after the closure of the Langeac Mine near Puy in Haute-Loire during 1979.

The Société General de Recherches et d'Exploitation Minières (SOGREM) increased capacity of its plant located near an opencast mine at Montroc, Tarn, to over 50,000 tons per year of concentrates. In addition to the Montroc Mine, SOGREM operated an underground mine, Le Bourg, near Albin in Tarn.

DAM produced fluorspar ore from an opencast mine based on the deposit at Escarro on Mount Canigou, about 50 kilometers southwest of Perpignan. The Escarro Mine has proven reserves reported at about 1.5 million tons of fluorspar. Compagnie Francaise de Mokta, formerly the Compagnie Francaise des Minerais d'Uranium, operated two mines, at Reclesne in Saone and at d'Argentolle in Loire.

The Société Industrielle du Centre produced fluorspar at its Rossignol Mine near Chaillac in Indre. Société des Mines du Haut du Them produced less than 5,000 tons of metspar from a mine at Mexaconchamp in the Vosges.

Gypsum.—France was the largest producer of gypsum in Europe during 1980. The major producing areas were the Paris Basin, the Rhone Basin, Alsace-Lorraine, the Atlantic Pyrenees, the Jura, the French Alps, Provence, and Charente.

The most important gypsum operations of the Société Anonyme de Material de Construction (SAMC) were at Taverny, Penchard, and Vaujours in the Paris Basin, at several mines in Alsace-Lorraine, and at Pouillon in the Atlantic Pyrenees. The

Taverny Mine, rated 1.1 million tons per year and located northwest of Paris, was an underground mine, using a room and pillar mining method. The gypsum bed was 8 to 12 meters thick and reportedly extended over an area of 1,500 hectares. Reserves were reported at 150 million tons of 97% to 98% gypsum with very small quantities of calcium carbonate. To the east of Paris, the Penchard underground mine produced about 400,000 tons of gypsum per year. Reserves at Penchard were reported at 10 million tons of 96% gypsum, in a 15-meter-thick bed. At the Vaujours deposit an opencast mine produced about 800,000 tons of gypsum per year.

In Alsace-Lorraine, two underground mines produced about 400,000 tons of gypsum per year. The operator was the Société Anonyme Anhydrite Lorraine, a subsidiary of SAMC and Knauf of the Federal Republic of Germany.

Lambert Industries, a joint subsidiary of Lambert Freres & Co. and Rhone-Poulenc S.A., operated two opencast mines, at Billeparisis near Vaujours and at Cormeilles west of Paris in the Paris Basin. Each mine can produce about 600,000 tons of gypsum per year. At Villaparisis production comes from two gypsum seams 17 meters and 8 meters thick.

Platrieres de France, a part of the Lafarge Group, produced gypsum from mines at Vazan, in Vaucluse, Auriol; Tarascon in the vicinity of the Rhone River; Portel to the north of Perpignan, Aude; St. Pierre de Martigues, Carresse, in the Atlantic Pyrenees; and Lontosque in the Maritime Alps in the southeast of France. In addition, smaller amounts of gypsum were produced by Platrieres de Grozon, Etablissements Boutaz, and Garandeau.

MINERAL FUELS

During 1980, the French Government continued to pursue its energy policy of reducing dependence on imported fuels and diversifying sources of imported energy. The Government continued to control imports and domestic prices of most products, inducing foreign oil companies to send the lowest priced crude to France in order to keep the market and maximize profits.

Two French companies, Total S.A. and Elf Aquitaine S.A., benefited from the Government's policy of negotiating agreements with producing countries. The Government, with interest in both firms, helped the companies in increasing their international stature and assisted them by underwriting their investments in France and abroad. Furthermore, the Government intended to help the companies in getting access to 111 million metric tons of crude by 1990. During 1980, bilateral oil agreements were signed with Mexico, Saudi Arabia, Iraq, and the U.S.S.R. In addition, an earlier oil agreement with Kuwait gave France direct access to Kuwait oil for the first time. Negotiations with Venezuela for an agreement for cooperation in investments for the processing of Orinco heavy oils continued during 1980, but no agreement was made public by yearend.

In the fall, the Government changed its energy balance for 1985 as follows, in million tons of oil equivalent:

Estimated energy consumption, 1985

	Revised estimate	Previous estimate	Actual 1979
Coal	30	29	33.9
Natural gas	36	36	23.2
Petroleum	101	106	108.2
Hydroelectric	14	14	15.8
Solar-geothermal	1	--	--
Total	182	185	189.1

During 1980, promotion and development of French nuclear power remained the most dynamic part of the French effort to reduce dependence on imported liquid hydrocarbons and resolve energy shortages. Although the program was effectively managed, construction was slowed down by strikes and delays in obtaining site authorizations.

Coal.—According to preliminary reports the downtrend in coal production continued during 1980, although output of lignite remained at the same level as in 1979.

To illustrate the drop of coal production, the following tabulation shows production of coal in France by basins for 1959 and 1979.

Basins	1959	1979
Nord: Pas-de Calais	29,248	5,386
Lorrain	15,142	9,595
Center Midi	14,332	5,155
Subtotal	58,722	20,136
Others	1,058	929
Total	59,780	21,065

Mine productivity reached 3,171 kilograms per shift during 1979.

At the beginning of 1980, the capacity of 26 washeries totaled 13,872 tons per hour of

raw coal. Roughly 19 washeries with a capacity of 10,520 tons per hour could treat fines and grain; 4 installations with a capacity of 1,312 tons per hour treated only grains, and 3 installations with an hourly capacity of 970 tons could treat only fines.

The consortium Groupe d'Etude de la Gazeification Souterraine announced success in its pilot program at Bruay to fracture the coal seams with water. Two wells were drilled a few dozen meters apart, water was injected at pressures up to 800 atmospheres, seams were fractured and communication was established between the wells. A second phase will include ignition of the coal and injecting oxygen in one well and recovering gases at the other. The collected gas is later transformed into methane. About 2 billion tons of coal reserves in France are not amenable to economic and safe production because of difficult geological conditions including gas, water, and thin seams but could be used for underground gasification.

Natural Gas.—As in the past, France was dependent on imported natural gas. Domestic production covered one third of the country's demand during 1980. The gasfield et Lacq remained by far the major producer. According to incomplete reports, it appeared that the construction of the natural gas vaporization plant was completed at the methane terminal at Montoir de Bretagne. Reported capacity of the facility was 1,200 cubic meters of liquefied natural gas per hour. At Fos, a seaport in southern France, an 80,000-cubic-meter underground gas storage space was completed.

In February, the first direct deliveries to France of gas from the U.S.S.R. started, under an agreement for the delivery of 4 billion cubic meters annually. In addition, France was negotiating with the U.S.S.R. to participate in construction of a gasline between the U.S.S.R. and Western Europe, but an agreement was concluded during 1980.

Petroleum.—France remained dependent on imported crude to meet its demand. About 99% of crude processed in France was foreign.

Two offshore wells drilled in the Iroise Sea and one in the Gulf of Lion were dry. During 1980, the first phase of the development of the oil deposit Vic Birh, Lacq, in southern France was completed. An additional six wells were needed to assess the deposit, which is very complex. Elf Aquitaine expected production from Vic Birh to reach 200,000 tons per year from 12 wells during 1981. In the Paris Basin, the well in the Chateaurenard Field started using territory methods for production by injecting microemulsions-polymers.

At the beginning of 1980, 22 petroleum refineries were operational in France, with an annual capacity of about 167 million tons. During 1980, refineries operated at about 76% capacity. At the Esso SAF refinery, at Port Jerome, construction of a dewaxing unit with a capacity of 367,000 tons of dewaxed lubricants was completed in the late part of 1980.

Supply of refineries with crude oil was mostly done through pipelines. The following tabulations show movement of crude oil for 1978-79 (the latest years for which data were available):

	1978	1979
South European pipeline:		
Movement of crude for France	17,933	17,871
Total movement of oil through pipeline	36,854	39,903
Ile de France pipeline	7,327	8,710
Lorraine refinery pipeline	3,722	3,280
Sarre pipeline	2,110	2,754
Carling	813	713
Donges-Vern	1,079	343
Antifer Le Haure	33,453	34,079
Berre-Monasgne	2,015	2,352
Parentis-Ambes	690	686
Trapil-Vernon	3,224	3,265
Le Harve-Valenciennes	2,689	2,935

Capacity for storage of liquid hydrocarbons at the beginning of 1980 was as follows in million cubic meters:

In refineries	43.5
Underground	12.4
Outside refineries	13.9
Total	69.8

For petroleum transport, France owned and operated a fleet of 72 boats. During 1979, five tankers were scrapped and four new ones were added to the fleet. About 89% of imported crude was moved by tankers flying the French flag.

The French Trade Ministry concluded two contracts with the U.S.S.R. for the sale of equipment for construction of offshore oil drilling platforms. Approximations set the values of both contracts at 500 million francs (about US$100). According to the contract the French companies, Entreprise pour les Petroliers Maritime and Union Industrielle et d'Entreprise, will deliver equipment for the construction of oil drill-

ing platforms at Astrakhan and Baku on the Caspian Sea. The three additional contracts for technical expertise require use of French experts on the construction sites. Deliveries of equipment were scheduled to start in the summer of 1981 and reportedly the platforms would be completed by 1983.

Uranium.—During 1980, the Compagnie General des Matieres Nucleaires (COGEMA) completed development of a uranium mine at Lodeve, Herault. According to reported plans the new mine should produce 800 to 1,000 tons of U_3O_8 annually. In addition, COGEMA announced discovery of a uranium deposit in the area of Contras, Gironde. Reportedly proven reserves were 20,000 tons of U_3O_8.

Development of nuclear powerplants continued to ensure a share of 50% in the total power-generating capacity of France by 1985. The most significant event was the beginning of operation of the Agence National Pour la Gestion des Dechets Radioactifs (ANDRA; National Agency for the Management of Radioactive Wastes). Although nuclear waste questions have been managed by groups within the Commissariat a l'Energie Atomique (CEA), the Government recognized that as the production of nuclear wastes increased with the rapidly expanding French nuclear program, the overall management of short- and long-term radioactive wastes must be handled by an industrial organization. While ANDRA reports to the CEA, it will have an independent budget (about $23 million in 1980) and coordinate with appropriate Government agencies in the management of short-term waste storage areas at Cap de la Hague and the establishment of new facilities for long-term waste storage.

The Eurodif uranium enrichment facility, which is to provide enriched fuel for the French nuclear program and for sale to others, began operation in late 1979 with the output of 2.6 million separative work units expected by the end of the year. With full plant operation expected in 1981, enrichment capacity should be 10.8 million separative work units per year.

Construction was proceeding on the 1,200-megawatt-electrical Super Phenix fast breeder reactor (FBR), with operation now scheduled for 1984, according to a Ministry of Industry report. This indicates a slippage of 1 year from the formerly scheduled 1983 date. In line with its commitment to pursue FBR's, the Government has just announced plans to order two additional reactors similar to Super Phenix but with a power level of 1,500 megawatts electrical each. Reports indicate the two new reactors would also be constructed at the Super Phenix site, with work to begin in 1985 and operation expected in 1990.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from French francs (F) to U.S. dollars at the rate of F5.00 = US$1.00.

The Mineral Industry of Gabon

By Peter J. Clarke[1]

The economic recovery that began in 1979 continued throughout 1980, maintained by higher prices for Gabon's principal exports, petroleum and manganese, and strictly controlled levels of imports. The nominal gross domestic product (GDP) increased 27% from $2.85 billion in 1979 to $3.62 billion[2] in 1980, which represents around 15% real growth. Around 71% of the total GDP growth was due to higher petroleum prices. Other sectors of the economy that showed significant growth rates were transportation (24%), industrial (22%), retail sales (19%), and other services such as banking, real estate, medical, insurance, and advertising (24%). The mining sector's contribution to the GDP declined 12% in 1980. The petroleum sector accounted for about 50% of the GDP, while mining contributed 5% to the total.

Despite a decrease in its contribution to the country's economy, the mineral sector was important in terms of world supply of critical minerals. Gabon remained the world's fourth largest producer of manganese and a leading supplier of uranium. Manganese production provided about 7% of Gabon's export earnings, while uranium supplied about 5% of the total. Petroleum provided about 75% of the country's export earnings, and over 55% of the Government's total receipts.

The minerals sector was preparing to make a much larger contribution to the country's overall development, pending the completion of the Trans-Gabon Railroad. The railroad was the country's top development priority. It was to provide a vital link between the resources of the country and the ports from which they would be exported.

The railroad was to run from the coastal Port of Santa Clara inland through Owendo and Ndjole and then to Booue. At Booue, the rail was to split into two lines. One was to go northeast to Mekambo, where the Belinga iron ore deposits are located, and the other was to head southeast to Franceville to link the Mounana uranium deposits and the Moanda manganese mines. The only section of the railroad that was operating in 1980 was the 182-kilometer link between Owendo and Ndjole. Another 500 kilometers of track was necessary to complete the project. The roadbed and track was being laid from Franceville, but the link to Booue was not expected to be completed until 1985. Completion of the whole project was revised for sometime in 1987. Over $1 billion had already been invested in the project.

While further mineral development was awaiting completion of the Trans-Gabon Railroad, a major exploration effort was underway in the petroleum sector. Essence et Lubrificants de France (ELF)-Gabon, the country's largest oil company, along with other companies from the United States, the United Kingdom, Finland, and Austria were exploring in Gabon's offshore waters for additional petroleum reserves. Through its attractive joint-concession offers, the Government hoped to attract other oil companies and possibly stop the continuing decline in crude oil production.

PRODUCTION

Production of Gabon's major mineral commodities remained fairly stable, with declines in both petroleum and gold production. Most of the country's nonoil resources were being extracted at full operating capacity, and no expansion plans were being implemented until the transportation system could accommodate the increase. However, the value of production remained fairly stable for all commodities. Petroleum was the major currency earner with production valued at about $2.0 billion, an 11% increase over the 1979 value, despite the 9% drop in actual production. Manganese was second, with production valued at approximately $145 million, followed by uranium ($110 million), cement ($14 million), and gold ($200,000).

Petroleum was expected to remain the major currency-earning mineral commodity for several years, despite a continuing decline in production. Both petroleum and gold production was expected to continue their trend toward lower production levels, owing to depletion of reserves. Production levels for manganese and uranium were expected to significantly increase when the Trans-Gabon Railroad reaches the mining areas, allowing a greater capacity route to ports.

Table 1.—Gabon: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979	1980[p]
Cement, hydraulic metric tons	107,000	190,000	[e]190,000	96,205	109,430
Diamond, gem and industrial carats	NA	NA	NA	NA	557
Gas, natural:					
Gross million cubic feet	64,484	61,694	64,449	[e]64,000	[e]58,000
Marketed do	5,968	6,250	5,827	6,549	2,538
Gold, mine output, metal content troy ounces	3,086	2,572	965	964	553
Manganese:					
Ore, gross weight (50% to 53% Mn) metric tons	2,216,759	1,850,529	1,661,020	2,188,445	2,044,049
Pellets, battery and chemical grade, gross weight (82%-85% MnO_2) do	65,000	78,000	93,000	111,649	102,703
Total do	2,281,759	1,928,529	1,754,020	2,300,094	2,146,752
Petroleum:					
Crude thousand 42-gallon barrels	82,042	79,032	76,176	70,991	64,444
Refinery products:					
Gasoline do	1,260	1,058	1,142	850	886
Jet fuel and kerosine do	870	730	2,308	740	1,391
Distillate fuel oil do	2,845	5,073	3,275	2,286	2,545
Residual fuel oil do	4,554	3,650	5,662	4,150	4,140
Other do	695	1,971	2,496	684	142
Refinery fuel and losses do	999	--	534	274	14
Total do	11,223	12,482	15,417	8,984	9,118
Uranium oxide (U_3O_8), content of concentrate metric tons	[r]1,138	[r]1,068	1,205	1,297	1,218

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Aug. 25, 1981.
[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is also produced, as well as diamond from artisan works, but output is not reported and available information is inadequate to make reliable estimates of output levels.

TRADE

Gabon's balance-of-payments situation continued to improve in 1980. Preliminary figures indicated a merchandise trade surplus of about $1.7 billion. The value of imports increased 21% in 1980 over that of 1979, while the value of exports increased 37%, owing largely to price increases for petroleum and wood products. Gabon's current accounts balance showed a surplus of $610 million and, with a capital account deficit of $551 million, the overall balance of payments showed a surplus of about $60 million. The country's major exports in order of decreasing value were: Petroleum, manganese, wood, and uranium. While France remained Gabon's largest single trading partner, the United States purchased the largest share of Gabonese oil (about 22%), followed by the Latin American and Caribbean countries and then France and other European countries. Gabon's manganese went primarily to France (25%), Norway (13%), Italy (10%), and the United States (7%). All of Gabon's uranium was exported to France, under contract with the French Commissariat à l'Énergie Atomique (CEA).

Table 2.—Gabon: Exports of mineral commodities

Commodity	1976	1977	Destinations, 1977	
			United States	Other (principal)
Manganese ore concentrate thousand metric tons	2,217	2,162	243	Canada 620; France 357; Japan 252.
Petroleum, crude thousand 42-gallon barrels	76,739	73,660	13,295	France 14,005; Brazil 8,730; Canada 7,397.
Uranium and thorium ores and concentrates metric tons	(1)	9,000	--	All to France.

[1]Quantity unreported; exports in 1976 were valued at $35,055,000 and in 1977 were valued at $5,265,000.

Table 3.—Gabon: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, semimanufactures	385	516	--	France 407; Belgium-Luxembourg 37.
Copper metal including alloys, semimanufactures	80	116	--	France 103.
Iron and steel metal, semimanufactures:				
Bars, rods, angles, shapes, sections	29,617	33,317	--	France 25,383; Belgium-Luxembourg 4,606; Italy 2,054.
Universals, plates, sheets	8,070	12,254	NA	France 5,597; Italy 4,897; Japan 1,357.
Hoop and strip	172	203	--	NA.
Rails and accessories	20,930	78,810	--	France 63,607; Belgium-Luxembourg 15,150.
Wire	1,459	2,590	NA	France 2,103; Belgium-Luxembourg 464.
Tubes, pipes, fittings	39,135	16,199	8	France 12,738; West Germany 2,026; Japan 424.
Castings and forgings, rough	147	--		
Other: Oxides, hydroxides, peroxides	--	174	--	France 164.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	132	39	--	France 35.
Cement, hydraulic	183,840	202,763	--	France 128,332; Spain 29,575; Ivory Coast 20,843.
Clay products:				
Refractory including nonclay brick	18	184	--	NA.
Nonrefractory	3,264	5,415	NA	France 3,066; Italy 1,554; West Germany 406.
Fertilizer materials, manufactured:				
Nitrogenous	--	395	--	France 307.
Other including mixed	--	33	NA	France 18.
Gypsum and plasters	572	5,767	NA	Spain 4,277.
Lime	--	1,073	--	Belgium-Luxembourg 748.
Salt	1,685	2,656	NA	France 1,423; West Germany 494.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	155	968	--	Italy 662; France 230.
Worked	176	4,225	--	Italy 3,713; France 512.
Gravel and crushed rock	12,329	165,379	--	Spain 97,190; Ivory Coast 35,337; France 32,851.
Sulfur, elemental	3,023	--		
Other:				
Crude:				
Refractory minerals	3,833	3,302	--	United Kingdom 2,041; France 748; Spain 512.
Unspecified	13,674	4,672	NA	France 2,345; Ireland 1,884.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	533	1,169	NA	France 392; Belgium-Luxembourg 112.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline 42-gallon barrels	r22,338	66,054	--	Ireland 21,998; France 19,474; Netherlands Antilles 15,674.
Kerosine do.	--	2,030	--	NA.
Lubricants do.	30,247	50,666	NA	France 36,967; Belgium-Luxembourg 8,330; Ivory Coast 2,338.
Liquefied petroleum gas do.	--	4,652	--	All from France.
Bitumen and petroleum coke do.	12,776	16,117	--	France 10,724; Spain 4,721.
Other do.	2,541	4,767	NA	NA.

[r]Revised. NA Not available.

COMMODITY REVIEW

METALS

Gold.—Gold production in Gabon has declined unevenly from the early 1960's when output was over 30,000 troy ounces, to 1980 when production totaled 553 troy ounces. Most of the mines were abandoned gradually after reserves were mostly depleted, and operations were no longer economic. The recent high price of gold had some officials contemplating returning to a systematic exploitation of the old mines, but no action was taken during the year. Gold was produced primarily in the Eteke region and used mostly in jewelrymaking within the country, which made inventory of production difficult. Gold output, valued at approximately $200,000, was sold by the Société Gabonaise de Recherche et d'Exploitation Minière (SOGAREM). Some gold was also mined from the Lastoursville, Makokou, and Ndjole regions, all by small workers. Despite the higher price of gold and the Government's interest in reactivating old mines, gold output was expected to remain low unless significant new discoveries were made.

A gold discovery in the Mont Bouet District held some promise for increased production in the future, although information regarding the deposit was limited. Gold was apparently discovered by workers remodeling and expanding the Mont Bouet market. Initial estimates indicated a large deposit, but no reserve figure was available.[3]

Iron Ore.—Development plans for the Belinga iron ore deposit remained at a standstill, awaiting completion of the 250-kilometer Booue to Belinga leg of the Trans-Gabon Railway. Reserves at Belinga, located in northeast Gabon, were estimated at 910 million tons of between 60% and 68% iron content, of which 188 million tons was low in phosphorus. The deposit was to be developed by the Société des Mines de Fer de Mekambo (SOMIFER), which was owned by the Gabonese Government (41%), Bethlehem Steel Corp. (United States) (20%), Exploration Bergbau (Federal Republic of Germany) (10%), Industrialexport (Romania) (5%), Finsider (Italy) (3.5%), the Bureau de Recherches Géologiques et Minières (BRGM) (France) (3%), Solmer (2.4%), Banque de Paris et de Pays-Bas (1%), Hoogovens (Netherlands) (0.5%), and a Japanese group (13.6%). Belinga was to be mined by open pit methods and produce between 7.5 and 10 million tons per year of ore. Development was expected to cost about $100 million.

Linking the deposit in Belinga to Booue and to the already operating segment from Ndjole to Owendo and then to Santa Clara was the only factor holding up the development of the project. The mine, located near Mekambo, was in the eastern-most portion of the country, near the Congolese border. Under the revised schedule for completing that leg of the railroad, the earliest movement of ore would be 1986. The shareholders in the project have limited their investments until the fate of the railroad was clear, and a decision to start development work on the deposit was postponed until 1982.

Manganese.—In 1980, Gabon remained the fourth largest producer of manganese ore and the world's largest producer from a single mine. For the past 2 years, output has been above 2 million tons from the Moanda Mine in the far southeastern portion of the country. Gabon supplied about 8% of world manganese output, behind the U.S.S.R., which produces about 38% of the total, the Republic of South Africa which supplied about 21% of world output, and Brazil which also supplied about 8%.

The manganese deposits at Moanda were operated by the Compagnie Minière de l'Ogooue S.A. (COMILOG), the capital participation in which was BRGM (France) (22%), Compagnie de Mokta (14%), Société Auxiliare du Manganese de Franceville (SAMAF)— Minière del Oubanghi Oriental—Banque de Paris et des Pays-Bas (15%), and United States Steel Corp. (49%). The mine and transportation network began operation in 1972.

The ore bodies at Moanda consist of the cappings on the tops of five adjacent plateaus, the Bangombe, the Okouma-Bafoula, the Yeye, the Messando, and the Boouba. The three western-most plateaus, Bangombe, Okouma-Bafoula, and Messando, have been fully explored, but ore occurs over the entire area in a more or less horizontal bed from 3 to 7 meters in thickness. The manganese minerals are essentially oxides. As of 1980, only the Bangombe was being exploited. Mining is by open pit methods using walking draglines for stripping and excavating. The ore is beneficiated by simple crushing, washing, and screening.

Salable ore represents about 60% to 70% of the total run-of-mine.

Reserves on the three explored plateaus were estimated at 450 million tons of ore, from which 200 million tons of salable product could be extracted. The richest zones, on the Bangombe and Okouma-Bafoula plateaus, cover 8.5 square kilometers and contain 75 million tons of salable product.

The transportation system was the limiting factor in ore extraction. The current method is to load the ore onto an aerial cableway 78 kilometers over mountainous forested country from Moanda to Mbinda on the Congolese side of the border. The ore is then loaded onto COMILOG's own railways for 285 kilometers to Mont-Belo, where the company railway connects with Chemin de Fer Congo-Ocean, which is the main rail line between Brazzaville and Pointe Noire on the Congo coast. COMILOG also constructed loading, storage, and reclamation facilities at Ponte Noire. Maximum capacity of the transport system was about 2.5 million tons per year. The Trans-Gabon Railroad was scheduled to reach Moanda by 1985, after which the mine capacity could be expanded to a planned 4 million tons per year. The railroad was to terminate at a new port at Cape Santa Clara, 25 kilometers north of Libreville. The terminus was to handle manganese from COMILOG and also iron ore from Belinga. Two berths were to be constructed at Santa Clara, one to handle vessels up to 280,000 dead-weight tons and load from stockpiles at 10,000 tons per hour. The other was to handle up to 60,000 dead-weight tons and load at 4,000 tons per hour.

High-grade manganese ore was also produced at Moanda. About 102,700 tons of 83% MnO_2 was produced for sale as battery-grade ore for the dry cell industry. Batteries were produced by Société Gabonaise des Piles (SOGAPIL), which was owned 20% by the Government, 20% by COMILOG, and 20% by Wonder Inc., with the remaining shares in private hands. Production capacity at the plant was 12 million 1.5-volt batteries per year. Gabon was the largest producer of battery-grade manganese in the world. Around 5% of the run-of-mine ore was separable as battery grade.

Uranium.—Not far from the manganese deposits at Moanda, a major uranium deposit was centered around the Mounana region. Three deposits have been delineated at Oklo, Boyindzi, and Okelobondo, but only the Oklo Mine was producing uranium. Infrastructure development for the Boyindzi deposit began in 1979, but exploitation was not scheduled until the middle of the decade.

Ore from the Oklo Mine was excavated by both open pit and underground methods. Underground exploitation began in 1978, thereby raising production capacity of the operation to about 1,200 to 1,500 tons per year of uranium metal. The mine was operated by Compagnie des Mines d'Uranium de Franceville (COMUF), which was owned jointly by the Gabonese Government (25%), Cie. de Mokta (28%), the French CEA (15%), Minatome S.A. (France) (13.2%), Compagnie Française des Minerais d'Uranium (7.5%), Cie. des Mines d'Huaron (3.75%), and Compagnie de Gestion d'Investissements Internationaux (7.5%).

Ore from Oklo was processed to yellowcake at a plant in Mounana that began operating in 1978. The run-of-mine ore contained an average of 5% U_3O_8. The first processing plant enriched the ore to between 35% and 55% U_3O_8. The throughput capacity of the plant was 240,000 tons of ore. The yellowcake plant produced a 70% to 75% uranium concentrate. Capacity of the plant was 1,000 tons per year of contained uranium metal. All of Gabon's uranium concentrate was sold under contract to the French CEA.

Speichim S.A. (Empian Schneider Group) (France) and Techminemet S.A. (Imetal Group) (France) were awarded a joint contract worth $50 million to construct a uranium ore processing plant at Mounana. The plant was designed to produce 1,500 tons of uranium per year as magnesia uranate. The project was to be completed in 1982.

Uranium exploration was continuing in Gabon, concentrated in the region between Mounana and Lastoursville to the northeast. In January 1980, an agreement was signed by the Korean Electric Co., COGEMA of France, and the Gabon Government for exploration of the Lastoursville region, an area previously under concession to COGEMA alone. The Korean company was to commit $12 million in exploration capital over a 1-year period.

NONMETALS

Barite.—Barite was first discovered in Gabon in 1960, by the BRGM. The deposit, which was estimated to contain about 1 million tons of ore with a barite content of 47%, was located at Dourakiki in the Nyanga region, 110 kilometers north of Mayum-

ba. A joint company composed of the BRGM, COMILOG, ELF-Gabon, and the Gabonese Government, was formed to exploit the deposit. The initial project was to start exploitation of a 25,000- to 50,000-ton reserve base. Benefication by gravitational methods was to provide about 80% of the run-of-mine as salable product. Output was to be sold domestically, with the remainder being exported to Cameroon and the Congo. Zaire, Angola, and the Ivory Coast also expressed interest in Gabon's barite. No startup date for the project was available.

Cement.—Cement production remained below capacity at Gabon's only operating plant. The clinker-grinding plant, operated by Société des Ciments d'Owendo, had an annual production capacity of 270,000 tons. Principal shareholders in the plant were the Gabonese Government (20%) and Ciments Lafarge S.A. (France) (71.3%).

Two new cement plants were under construction in 1980. Both plants were being built under contract by Cruesot Loire Enterprises and Lafarge Conseils et Etudes, both of France. The first plant, located near Ntoum, about 40 kilometers from Libreville, was to produce 350,000 tons of cement per year, utilizing local raw materials. The second plant was to be constructed at Franceville. The plant was to have a 100,000-ton-per-year grinding capacity. With all three plants onstream in the early 1980's, Gabon was expected to satisfy its domestic requirements for cement and have some surplus available for export. Annual consumption of cement was about 220,000 tons in 1980, but was expected to increase as the economic situation improved. The two new plants were to be operated by Société des Ciments de Gabon (which was owned by the Government) (51%), ELF-Gabon (19%), Ciments Lafarge (15%), and Société des Ciments d'Owendo (15%).

Talc.—The Gabonese Government, in association with BRGM, was continuing its investigation of talc deposits in the N'dende-Tchibanga region. The Government considered exploitation of the deposits as feasible, and was investigating the infrastructure requirements for talc extraction and exports. Involved in the investigation project were the Gabonese Government, the BRGM, and another French company, Société du Talc de Luzenac. Earliest possible exploitation of the deposit was set at 1983. A group of Japanese businessmen from C. Itoh and Co. discussed conducting a feasibility study for a talc processing plant in 1980, but no definite plans were made.

MINERAL FUELS

Natural Gas.—Production of natural gas in Gabon declined slightly in accordance with the decline in crude oil output. All of Gabon's natural gas was associated gas. About 95% of the country's gas production was flared in 1980. The remainder was used for power generation. Reserves of natural gas remained stable, at about 70 billion cubic meters.

Petroleum.—*Production.*—Gabon's crude oil production, mostly from offshore fields, continued to decline in 1980. Production during the year averaged just under 180,000 barrels per day compared with a peak of about 224,000 barrels per day in 1976. An intensive exploration effort was underway during the year, attempting to halt the decline, and several new discoveries were put into production in 1980.

Oil production began in Gabon in 1957, around the Port Gentil area. Development and production has centered around this region ever since and only recently expanded to the southern part of the country's offshore region. ELF-Gabon was the dominant company in the country, producing about 80% of the country's crude oil. ELF-Gabon was owned 25% by the Government, and 75% by Essence et Lubrificants de France-Enterprise de Recherches et d'Activités Pétroliès (ELF-ERAP). ELF-Gabon operated 14 fields by itself and 14 others in conjunction with other companies. Its major fields and levels of production were: Grondin (10,500 barrels per day), Gamba (4,170 barrels per day), Torpille (3,475 barrels per day), Girelle (2,900 barrels per day), Breme (2,500 barrels per day), and Madaros (2,360 barrels per day). Over 84% of the total production from ELF fields was from offshore. All of ELF-Gabon's fields were linked into a three-pipeline network, which connects with a single tanker loading terminal at Cap Lopez.

Shell Gabon, a subsidiary of U.S. Shell, was the country's second largest producer. The Gabonese Government also held a 25% share in Shell Gabon. Shell's major fields, which were shared with ELF-Gabon, were the Gamba and Lucina Fields. Production from the Gamba Field continued to decline, and Shell was in the midst of a major exploration drive to increase its output in the near future.

Other foreign companies also operate in Gabon, mostly in joint ventures with ELF-

Gabon. Gulf-Gabon, a subsidiary of Gulf Oil Corp. (United States), shared production with ELF from the Lucina and Olende Fields. Mobil Oil Corp. also operated a share in the Batanga offshore fields. Other companies, their production levels and shares in total production in 1980, were as follows:

Company	Production (barrels per day)	Percent of total
ELF-Gabon	121,938	69.1
Société Nationale Elf-Aquitane	28,551	16.2
Shell Gabon	13,669	7.7
Ocean Drilling and Exploration Co. (United States)	4,185	2.4
Ocean	4,185	2.4
Gulf Oil Corp	2,495	1.3
Mitsubishi Petroleum Development Co. (Japan)	648	.4
Murphy	330	.2
Mobil Oil Corp. (United States)	193	.1
Hispanoil (Spain)	182	.1
Ensearch	180	.1

In 1979, the Gabonese Government set up a state-owned oil company, the Société Nationale des Pètroles Gabonaise (PETROGAB), and required equity participation in all oil companies of 25%. The private companies were then required to deliver 25% of their crude oil output to the state company. PETROGAB sold most of its allocated output on the spot market in 1980, with the remainder through short-term contracts. New exploration contracts could only be obtained as production-sharing ventures with the state company.

Exploration.—ELF-Gabon and Shell-Gabon, along with several other international and small private companies, have joined a major exploration effort in Gabon. The effort was begun late in 1979 when the economy began to show signs of improvement. Development work was still centered around the Port Gentil area, but several small discoveries have been made in the southern waters near the Congo border. In addition to the companies already operating, Acorn Petroleum, a subsidiary of Nigeria's Lawson Group, Neste Oy (Finland State Oil Co.), Burmah Oil (United Kingdom), Hudbay Oil (Canada), Norcen Oil and Gas Co. (Canada), and OMV Aktiengesellschaft (Austria) have joined together to undertake exploration on a 6,000-square-kilometer tract offshore Gabon. Acorn, which originally held the concession, was to retain a 44% share, with the other operators taking 11% shares.

Meanwhile, ELF-Gabon continued to concentrate exploration and development around its already established fields. Six drilling rigs were carrying out development work for ELF-Gabon at the end of 1980. Shell was exploring a 14,000-square-kilometer free zone, and also renewed its exploration permits in the Gamba South offshore, Cap Lopez offshore, and Grand Large areas.

Mitsubishi Petroleum Development Co., in conjunction with ELF-Gabon, recently started production from the new Baliste Field. Production began at about 1,500 barrels per day and was to build up to 7,000 to 8,000 barrels per day by the middle of 1981. In the southern waters off Gabon's coast, Gulf discovered the Mayumba structure and subsequently installed three wells that were producing 3,150 barrels per day by yearend. Also, Wed Gabon Oil Co., a company composed of Japan National Oil Co. (50%), World Energy Development (28.6%), and C. Itoh Energy Development (21.4%), in a joint concession with ELF-Gabon, discovered oil in the North Concession. Oil was discovered in the Batanga stone at a depth of 2,259 meters. Initial flow was 1,082 barrels per day.

These discoveries, and others sure to come, hold the potential of slowing, if not halting altogether, the steady decline in Gabon's crude oil output. Most industry sources expect output to stabilize at between 160,000 and 180,00 barrels per day, given Gabon's proven reserves of only 500 million barrels.[4]

Refining.—Two refineries were operating in Gabon in 1980. The Société Gabonaise de Raffinage (SOGARA) refinery at Port Gentil had an annual capacity of 12 million barrels of crude oil. The refinery was supplied crude oil from Madji Isle by an 18-kilometer pipeline. SOGARA was owned 51% by the Government, 18.75% by ELF-Gabon, 18.75% by Compagnie Française des Pètroles (CFP), and 11.5% by a group of petroleum marketing companies. Output from the refinery in 1980 was 794,363 tons of petroleum products, which represents about 60% of capacity. Petroleum products from the SOGARA refinery were sold mostly on the domestic market, with some gasoline and fuel oil being exported to Cameroon and the Congo.

Gabon's second refinery, also located in Port Gentil, came onstream in 1977. The

refinery was operated by the Compagnie Gabonaise-Elf de Raffinage (COGER), and was owned 30% by the Government and 70% by ELF-Gabon. Production capacity of the refinery was 40,000 barrels per day. Total production from the refinery in 1980 was about 500,000 tons of butane, naphtha, gas oil, and fuel oil. Exports from the COGER refinery were destined for France, the Federal Republic of Germany, Brazil, Italy, and the Netherlands.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Gabonese Communautè Financiere Africaine francs (CFAF) to U.S. dollars at the rate of CFAF220=US$1.00.

[3]The Libreville L'Union (Gabon). L'Union. Apr. 1, 1980, p. 4.

[4]Oil and Gas Journal. Gabon's Offshore Production Continues to Wane. Special report, Jan. 12, 1981, p. 58-59.

The Mineral Industry of the German Democratic Republic

By Richard Levine[1]

The German Democratic Republic (GDR) in 1980 continued to experience economic growth despite the increased burden of rising energy and raw materials costs. Reportedly, in 1980, the net national income of the GDR increased by 4.2% compared with a 4% increase in 1979. The gross industrial product grew by 4.7%, fulfilling the plan, but slightly down from the 4.8% growth registered in 1979. Although investment in the industrial ministries increased by 4% in 1980, total investment (including industrial investment and investment in the CMEA[2] countries) grew by only 2%. Over one-third of total investment was for energy and raw materials, and over 60% of industrial investment was used to increase the energy supply or to expand the raw materials base.

Rising energy and raw materials costs are significant in shaping the development of the economy and particularly the mineral industry. The GDR is engaged in a major effort to conserve and make more effective use of minerals. This is necessitated by the rising cost of imported minerals coupled with the large expenditure required to expand the domestic raw materials base. In addition, there will be the naturally increasing demand for energy and minerals. Insuring future supplies will become more difficult both through imports and from domestic supply as even minerals such as lignite, which the GDR has in abundance, become more expensive to produce, and eventually become scarce.

In an effort to stimulate savings on energy and raw materials, the GDR has introduced as basic economic indicators net industrial production and basic materials costs per 100 marks of gross industrial output. Gross industrial output alone has the undesirable effect of including inputs purchased outside the enterprise as part of industrial output, thus allowing increased energy and raw materials expenditures to be recorded as production. Net industrial output, on the other hand, excludes raw materials and energy purchased outside the enterprise. In 1980, net industrial production rose by 5.5%, exceeding gross industrial production, while savings on basic materials cost per 100 marks of gross industrial output exceeded the plan. This indicates that the GDR has been effectively implementing its energy and raw materials cost reduction program. An important component of this program is to conserve energy and raw materials through improved production methods and increased use of secondary materials. The country is presently able to provide approximately 10% of its industrial raw materials requirement using secondary materials.

The GDR is not richly endowed in most mineral resources except lignite and potash for which it is a leading world producer. For practically all ferrous and nonferrous metals, mine production is either insufficient or nonexistent. There is practically no mining of precious metals which are produced primarily from secondary materials. The GDR does produce enough building sand, gravel, salt, fluorspar, and kaolin along with certain other construction, cement, glass, and ceramic raw materials to meet its needs and for export. However, the country produces insufficient quantities of some nonmetals, such as pyrites and special clays and has no production of other nonmetals such as asbestos and magnesite.

The GDR relies heavily on its lignite production as a primary energy resource and in the future plans to replace petroleum with lignite for fuel and chemical pur-

poses. In 1980, the GDR remained the world's leading lignite producer with approximately 28% of the world's output. Although the GDR has been seriously affected by rising petroleum prices, owing to its large lignite production, it is less dependent on imported petroleum than many industrial countries. The country also produces some natural gas and very small amounts of crude oil, neither of which is sufficient for the needs of the economy.

Because of its poor raw materials base, the GDR relies heavily on imports for a large percentage of its minerals and is particularly dependent on the Soviet Union as its chief supplier. However, during the next 5-year period, 1981-85, the GDR will have to seek additional suppliers as Soviet imports of most essential minerals will not increase over their 1980 level.

PRODUCTION

Mineral production is administered by several ministries with each ministry responsible for specific minerals. The main ministries for minerals are the Ministry of Ore Mining, Metallurgy, and Potash; the Ministry of Coal and Energy; and the Ministry of the Glass and Ceramics Industry. The Ministry of Ore Mining, Metallurgy, and Potash administers the production of ferrous and nonferrous metals and the production of potash, rock salt, and spar. Approximately 143,000 workers are engaged in ferrous and nonferrous mining and metallurgy, 22,000 workers in the production of potash, and the remaining 10,000 workers in the production of rock salt, spar, and other enterprise activities. Subordinate to the Ministry are firms (Kombinat) that administer mining and metallurgical production at their subordinate enterprises. The Ministry also administers foreign and domestic trade along with technical schools, research facilities, and recycling activities. Within the other ministries, there have been reported estimates of 28,000 workers engaged in coal mining and 2,000 workers engaged in the silicate mining industry.

In 1980, production of most mineral commodities either increased or remained at their current level. Many of the figures reported in table 1 are estimates because the GDR does not officially report production of many mineral commodities. In addition, the country is 1 to 2 years behind in publishing many of the statistics that it does report. Current estimates will be revised after the official figures are published.

Table 1.—German Democratic Republic: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Alumina	44,468	38,953	37,585	41,000	41,000
Metal, primary[e]	60,000	65,500	60,000	64,500	64,500
Cadmium metal, primary[e]	r18	r18	r18	r15	15
Copper:[e]					
Mine output, metal content	16,000	17,000	16,000	r15,000	15,000
Metal:					
Smelter	16,000	18,000	17,000	r19,000	19,000
Refined, including secondary	50,000	51,000	49,000	r51,000	51,000
Iron and steel:					
Iron ore, gross weight[3] thousand tons	r59	66	80	70	70
Metal:					
Pig iron do	2,528	2,628	2,560	2,386	4,2460
Ferroalloys[5] do	154	154	164	155	150
Crude steel do	6,732	6,850	6,976	7,023	4,7308
Semimanufactures (hot-rolled only) do	4,593	4,802	5,002	5,100	5,200
Lead:[e]					
Mine output, metal content, recoverable	4,000	--	--	--	--
Metal, refined, including secondary	36,000	37,000	38,000	r40,000	40,000
Nickel:[e]					
Mine output, metal content, recoverable	2,500	2,500	2,700	r2,500	2,500
Metal, refined	2,800	2,800	3,000	3,000	3,000
Silver, mine output, metal content, recoverable[e] thousand troy ounces	1,600	1,600	1,600	r1,550	1,600

See footnotes at end of table.

Table 1.—German Democratic Republic: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Tin:[e]					
Mine output, metal content, recoverable	1,300	1,400	1,600	1,600	1,600
Metal, including secondary	1,200	1,200	1,200	1,600	1,600
Zinc metal, including secondary[e]	15,000	15,500	16,000	[r]17,000	17,500
NONMETALS					
Barite[e]	31,000	31,000	35,000	35,000	35,000
Boron materials: Processed borax, $Na_2B_4O_7$ $10H_2O$ content	4,000	[e]4,000	[e]4,000	[e]4,000	4,000
Cement, hydraulic thousand tons	11,344	12,102	12,521	12,273	[4]12,444
Chalk[e] do.	50	50	50	50	50
Fluorspar[e] do.	90	100	100	100	100
Gypsum and anhydrite:					
Crude[e] do.	340	340	[r]350	[r]360	370
Calcined do.	302	304	309	319	330
Lime and dead-burned dolomite do.	3,404	3,367	3,443	3,500	3,500
Nitrogen, N content of ammonia do.	1,119	1,130	1,137	1,078	1,100
Potash, marketable, K_2O equivalent do.	3,161	3,229	3,323	3,395	[4]3,422
Pyrite, gross weight[e] do.	25	25	25	25	25
Salt:					
Marine do.	52	53	53	55	56
Rock do.	2,508	2,590	2,688	2,997	3,100
Total do.	2,560	2,643	2,741	3,052	3,156
Sodium compounds, n.e.s.:					
Caustic soda	440,589	423,486	414,988	548,000	550,000
Sodium carbonate	828,998	839,561	852,260	860,000	870,000
Sodium sulfate	149,218	137,579	130,799	127,000	127,000
Stone, sand and gravel:					
Crushed stone thousand tons	13,836	14,561	14,566	15,000	15,000
Sand and gravel do.	8,218	8,359	8,477	9,827	10,000
Sulfur:					
Byproduct:					
Elemental do.	79	[e]80	[e]80	[e]80	80
Other forms do.	250	260	270	270	270
From pyrite[e] do.	10	10	10	10	10
Sulfuric acid do.	957	927	971	952	950
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous do.	457	349	115	--	--
Lignite do.	246,897	253,705	253,264	256,063	258,350
Total do.	247,354	254,054	253,379	256,063	258,350
Coke:					
From anthracite and bituminous coal do.	1,693	[e]1,600	[e]1,500	[e]1,500	1,500
From brown coal:					
High temperature do.	2,123	2,240	2,297	2,373	2,450
Low temperature do.	3,362	3,020	2,857	2,769	2,700
Total do.	5,485	5,260	5,154	5,142	5,150
Fuel briquets (from lignite) do.	48,679	48,749	48,468	48,700	49,675
Gas:					
Manufactured million cubic feet	194,300	203,517	218,138	228,379	240,000
Natural, marketed production do.	304,520	300,343	302,426	302,450	302,450
Petroleum:					
Crude[e] thousand 42-gallon barrels	392	392	392	392	392
Refinery products:					
Gasoline do.	25,348	26,205	27,515	27,832	28,000
Kerosine, jet fuel, distillate fuel oil do.	38,823	41,048	42,583	45,300	48,000
Residual fuel oil do.	58,844	56,850	58,741	58,941	59,500
Lubricants do.	2,666	2,738	2,817	2,910	3,000
Asphalt do.	6,596	7,268	6,781	6,969	7,000
Total[6] do.	132,277	134,109	138,437	141,952	145,500

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through June 23, 1981.

[2]In addition to the commodities listed, magnesium, peat, and a variety of crude construction materials are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Source indicates that data include "roasted ore," presumably roasted pyrite.

[4]Reported figure.

[5]Figures represent the sum of estimates for silicon metal production (3,000 tons in 1976 and 1977 and 4,000 tons in 1978 and 1979) and reported figures for production of all other ferroalloys (1980 estimated).

[6]Total of listed products only; no estimates have been made for unreported products or refinery fuel and losses.

TRADE

The GDR must depend on imports to cover a large percentage of its raw material needs; therefore, foreign trade plays a large role in the economy. The GDR reports that in 1980, foreign trade turnover increased by 10% over the 1979 figure of 109 billion VM (valuta marks).[3] Approximately 65% of this trade turnover is with CMEA countries.

The Soviet Union is the GDR's largest trading partner upon which the GDR is heavily dependent for exports of raw materials. In 1980, the GDR imported the following commodities from the Soviet Union: 19 million tons of petroleum; 6.5 billion cubic meters of natural gas; 1.7 million tons of iron ore (iron content); 3.2 million tons of rolled steel; 130,000 tons of aluminum; 42,000 tons of copper; and 430,000 tons of apatite concentrates. There were some increases in deliveries of commodities such as petroleum and rolled steel, and a substantial increase in the delivery of natural gas. The GDR also imports other minerals such as zinc, nickel, manganese, and lead from the Soviet Union, but figures are not reported.

During the 1981-85 planning period, the GDR is scheduled to import from the Soviet Union 95 million tons of petroleum, 32.5 billion cubic meters of natural gas, 8.5 million tons of iron ore (iron content), 4.8 million tons of pig iron, 650,000 tons of aluminum, 211,500 tons of copper, 6.5 million tons of coke, and 21 million tons of hard coal. Although these trade figures are impressive and are proclaimed as such, the reality is that Soviet deliveries of petroleum, natural gas, iron ore, aluminum, and copper will remain at their 1980 levels during 1981-85, and the GDR will have to meet increased demand for these products from other sources.

The other CMEA countries will not be able to substantially supply the GDR with raw materials, although the GDR does import some significant raw materials from other CMEA countries. These materials include bauxite, alumina, and aluminum from Hungary, and hard coal from Czechoslovakia and Poland. The GDR in turn is able to supply the CMEA countries with lignite briquets, potash, salt, and building materials. The labor unrest in Poland has caused Polish exports of hard coal to drop sharply below the expected levels. To compensate, the GDR is trying to makeup some of the difference through increased imports from the Federal Republic of Germany (FRG) and is, in addition, trying to convert its furnaces to lower Btu domestic lignite.

The GDR is engaged in mutual ventures with the Soviet Union and the other CMEA countries to obtain energy and raw materials. These projects include the exploration for petroleum off the Baltic Coast and the construction of the Kiyembay Asbestos complex. In regard to the latter project, the GDR supplied the Soviet Union with structural metals, cables, cement, cranes, pumps, and locomotives, and in return is to receive 20,000 tons of asbestos in 1980, increasing to 40,000 tons in 1991.

Because U.S.S.R. petroleum exports to the GDR will remain at 19 million tons annually through 1985, the GDR is actively seeking other sources of petroleum and is cultivating relations with Iraq and Algeria, both of which exported petroleum to the GDR in 1980. The GDR is also developing relations with Mexico, Angola, and Iran, which in 1980 did not export petroleum to the GDR, although Iran previously did. In the past, the GDR also obtained petroleum from Syria and Libya, and it is uncertain whether these shipments are continuing.

The GDR would prefer to obtain its petroleum through other than hard currency payments, such as the now-canceled barter agreement which the GDR concluded with the Shah's Government in Iran. It now appears that nonbloc exporting countries will demand payment in hard currency. If the GDR is not able to obtain a stable supply of petroleum from outside the Soviet Union, the Soviet Union will be under pressure to increase its petroleum exports to the GDR.

Regarding trade with developed countries, in the first 6 months of 1980, exports rose almost one-third, and imports also rose. The GDR publishes no data on foreign indebtedness and estimates vary. The U.S. Department of Commerce estimates the GDR's hard currency deficit for end-year 1979 at 10.1 billion dollars and its 1979 debt servicing ratio at 51%.[4]

Trade between the GDR and the FRG comprises a significant portion of the GDR's trade with the Western countries. The GDR is recording increased exports to the FRG in part because of the sharp increase in the price of refined petroleum products that the GDR exports to the FRG. This exchange is based on a trade agreement whereby the GDR imports crude oil from the FRG and in

return exports refinery products to the FRG, particularly to West Berlin. In 1979, this trade agreement was set on a long-term basis. Trade between the GDR and FRG is expected to continue to increase. In 1980, the GDR and the FRG negotiated a 5-year skeleton trade agreement whereby the GDR will export annually 1.25 million tons of lignite briquets to the FRG, with an additional FRG option of 0.25 million tons. This does not include lignite deliveries to West Berlin, which are to be separately negotiated. As part of this agreement, the FRG will ship the GDR lignite-processing machines in which the coal is pulverized and better suited for use in certain industries. In addition, the GDR is an importer of bituminous coal from the FRG. According to a 1979 skeleton trade agreement, the GDR will purchase DM250 million worth of bituminous coal annually for a 6-year period from 1980 to 1985. The GDR might try to increase this amount because of shortages in supply from Poland.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1] [2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum metal including alloys:			
Scrap	2,997	2,272	France 1,321; Austria 608.
Unwrought	24,080	15,579	West Germany 12,565;[3] Japan 1,116;[4] United Kingdom 902.
Semimanufactures	7,344	6,584	Hungary 3,476; Poland 2,608.
Arsenic trioxide, pentoxide, acids	--	3	All to Greece.
Bismuth metal including alloys, all forms	--	2	All to Spain.
Chromium oxide and hydroxide	--	26	Greece 21.
Cobalt metal including alloys, all forms	5	--	
Copper:			
Sulfate	--	48	All to Greece.
Metal including alloys:			
Scrap	92	1,252	Netherlands 687; France 314; Belgium-Luxembourg 230.
Unwrought	14,708	15,352	West Germany 6,345;[3] Belgium-Luxembourg 5,419.
Semimanufactures	173	315	United Kingdom 182; Austria 94.
Iron and steel metal including alloys:			
Scrap	13,708	1,540	Thailand 1,278; Japan 224.
Pig iron	58,124	47,620	Philippines 19,961; Yugoslavia 16,783; Sweden 6,293; Austria 3,850.
Ferroalloys[5]	1,000	7,000	NA.
Steel, primary forms[5] thousand tons	374	296	Italy 152; Belgium-Luxembourg 15.
Semimanufactures:[5]			
Bars, rods, angles, shapes, sections do	604	688	Poland 54; Bulgaria 29; Yugoslavia 18.
Plates and sheets do	286	350	Poland 59; West Germany 41;[6] Italy 41.
Hoop and strip do	124	242	Italy 10; France 6.
Rails and accessories do	11	17	NA.
Wire do	68	63	NA.
Tubes, pipes, fittings do	105	118	Poland 30; Yugoslavia 17; France 13; Hungary 13.
Castings and forgings, rough do	25	62	Poland 12.
Lead:			
Oxides	637	799	Sweden 286; Italy 220; Yugoslavia 220.
Metal including alloys:			
Scrap	100	23	All to Sweden.
Unwrought	2,317	1,246	Austria 699; Netherlands 547.
Manganese oxides	4	9	Sweden 6; Ethiopia 3.
Molybdenum metal including alloys, all forms	3	--	
Nickel:			
Matte and speiss	10	--	
Metal including alloys:			
Unwrought	218	90	Netherlands 60; United Kingdom 19.
Semimanufactures	11	33	Canada 31.
Platinum-group and silver metals including alloys:			
Waste and sweepings value, thousands	--	$55	All to Switzerland.
Worked or partly worked:			
Platinum-group do	$12	$84	All to Netherlands.
Silver do	$38,649	$73,962	All to United Kingdom.
Tin metal including alloys, unwrought	7	27	Netherlands 20; Belgium-Luxembourg 5.
Tungsten metal including alloys, all forms kilograms	10	--	
Zinc:			
Ore and concentrate	--	363	All to Belgium-Luxembourg.
Oxide and peroxide	2,259	17	All to Sweden.
Metal including alloys, semimanufactures	10	5	All to Greece.
Other:			
Ores and concentrates, n.e.s	6	--	
Ash and residue containing nonferrous metals	14,370	13,975	Austria 12,625.
Oxides, hydroxides, peroxides, n.e.s	--	4	France 2; Pakistan 2.
Metals including alloys:			
Metalloids	15	3	All to Belgium-Luxembourg.
Base metals including alloys, all forms, n.e.s	6	21	All to United Kingdom.

See footnotes at end of table.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
NONMETALS			
Abrasives, n.e.s.:			
Pumice, emery, natural corundum, etc	2	--	
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	--	$5	All to Spain.
Grinding and polishing wheels and stones	154	173	Pakistan 38; United Kingdom 38; Italy 37; Greece 35.
Corundum, artificial	NA	22	All to Spain.
Barite and witherite	9,887	45	Belgium-Luxembourg 25; United Kingdom 20.
Boron materials: Crude natural borates	--	41	All to Italy.
Cement[7] thousand tons	1,131	1,183	Hungary 220; Czechoslovakia 77.
Chalk[6]	36,747	28,054	NA.
Clays and clay products:			
Crude:			
Fire clay	2,078	3,149	All to Poland.
Fuller's earth and chamotte	2,276	--	
Kaolin[6]	87,413	106,356	Poland 15,260; Hungary 12,790; Yugoslavia 12,685.
Other	7,019	6,314	All to Hungary.
Products:			
Refractory (including nonclay brick)	12,460	7,796	Hungary 4,078; Poland 1,617; Sweden 1,218.
Nonrefractory	4,597	7,425	Morocco 975; Belgium-Luxembourg 948; Yugoslavia 915.
Diamond:			
Gem, not set or strung value, thousands	$243	--	
Industrial do	$305	$2,390	Belgium-Luxembourg $2,230.
Feldspar and fluorspar	30,417	44,714	Poland 19,491; Netherlands 12,537; Austria 8,845.
Fertilizer materials:			
Crude:			
Nitrogenous	--	60	All to Sweden.
Phosphatic	797	968	Hungary 918.
Potassic	24,370	29,973	United Kingdom 14,831; United States 13,924.
Manufactured:			
Nitrogenous	15,040	65,834	Brazil 25,489; Portugal 12,448.
Phosphatic	--	4,860	All to Netherlands.
Potassic, K_2O content[6] thousand tons	2,744	2,745	Czechoslovakia 482; Poland 292; Brazil 220; Hungary 208.
Other, including mixed	3,256	655	Sweden 540.
Ammonia	14,308	4,864	Poland 4,194.
Graphite, natural	350	240	Yugoslavia 200.
Gypsum, calcined[6]	68,681	80,353	Hungary 43,851; Czechoslovakia 24,000.
Lime	10,354	10,210	All to Hungary.
Mica, worked	2	2	All to Belgium-Luxembourg.
Pigments, mineral: Processed iron oxides	r2	--	
Precious and semiprecious stones:			
Natural value, thousands	--	$14	All to United States.
Synthetic do	r$35	$15	All to Turkey.
Salt including rock salt[6] thousand tons	1,213	1,232	Sweden 95; Finland 67.
Sodium and potassium compounds, n.e.s.:			
Caustic soda[7]	11,700	77,600	Sweden 20,509; Netherlands 18,609.
Caustic potash	1,412	1,691	Hungary 1,335; Egypt 229.
Soda ash[6]	274,800	295,500	Czechoslovakia 65,000; Sweden 26,956; Finland 22,146.[6]
Stone, sand and gravel:			
Dimension stone:			
Crude or partly worked	r2,080	814	Norway 709; Belgium-Luxembourg 69.
Worked	r681	266	Netherlands 79; Belgium-Luxembourg 74; Norway 68.
Gravel and crushed rock[6]	267,881	296,918	NA.
Sand thousand tons	2,476	2,539	West Germany 2,472;[8] Austria 30; Yugoslavia 21.
Sulfur:			
Elemental other than colloidal	986	--	
Sulfuric acid[6]	41,208	34,522	NA.
Talc	--	24	All to Netherlands.
Other:			
Crude	10,886	13,001	United Kingdom 8,144; Hungary 4,709.
Slag, dross, and similar waste, not metal-bearing	--	728	Netherlands 608.
Oxides of magnesium, strontium, barium	1,279	1,049	Sweden 756; United Kingdom 158.
Halogens	--	460	Switzerland 278; Italy 182.

See footnotes at end of table.

Table 2.—German Democratic Republic: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	3,487	2,438	Bulgaria 679; United Kingdom 614.
Coal and briquets:			
Anthracite and bituminous coal, thousand tons	315	285	All to Poland.
Briquets of anthracite and bituminous coal, do.	r500	462	All to Hungary.
Lignite and lignite briquets[6], do.	2,211	1,806	West Germany 690; Czechoslovakia 343; Austria 164.
Coke and semicoke, do.	31	42	Spain 25; Austria 9.
Gas, manufactured, million cubic feet	[6]456	[6]343	Mainly to Netherlands.
Peat and peat briquets	218	166	France 105; Italy 61.
Petroleum refinery products:			
Gasoline[6], thousand 42-gallon barrels	3,270	3,340	NA.
Kerosine, do.	35	57	Hungary 56.
Distillate fuel oil[6], do.	7,341	6,932	Sweden 1,089.
Residual fuel oil[7], do.	2,631	4,562	Austria 1,062; Sweden 737.
Lubricants[7], do.	27	31	Austria 29.
Other:			
Mineral jelly and wax, do.	71	87	West Germany 24;[8] United States 13; Netherlands 11; Austria 10.
Bitumen and other residues, do.	1	1	All to Austria.
Unspecified, do.	430	255	All to Poland.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,500	2,496	Switzerland 998; Czechoslovakia 832.

rRevised. NA Not available.

[1]Owing to the lack of trade data published by the German Democratic Republic, this table should not be taken as a complete presentation of the German Democratic Republic's mineral exports. These data have been compiled from various sources which include United Nations information, data published by the trading partners, and partial official trade statistics of the German Democratic Republic.

[2]Unless otherwise specified, data are compiled from the official trade statistics of individual trading partners.

[3]World Bureau of Metal Statistics. World Metal Statistics, London.

[4]Metallgesellschaft AG. Metallstatistik, Druckerei C. Adelmann, Frankfurt am Main, 1980.

[5]United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[6]Official trade statistics of the German Democratic Republic.

[7]Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow.

[8]For January-September 1979 only.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979[3]	Principal sources, 1979[3]
METALS			
Aluminum:			
Bauxite[4]	251,500	133,800	Hungary 92,900; Yugoslavia 23,800.
Oxide and hydroxide	105,345	94,641	West Germany 73,842;[4] Hungary 20,757.
Metal including alloys:			
Scrap	45	125	All from West Germany.
Unwrought	43,117	38,382	Yugoslavia 27,620; Hungary 9,798.
Semimanufactures	14,999	21,015	West Germany 7,649; Hungary 6,921; Yugoslavia 5,652.
Bismuth metal including alloys, all forms	3	8	All from Japan.
Cadmium metal including alloys, all forms	--	10	All from Italy.
Chromium: Chromite, Cr_2O_3 content[4]	51,700	44,600	U.S.S.R. 14,570; Turkey 1,883.
Cobalt oxide and hydroxide	--	5	All from Netherlands.
Copper:			
Ore and concentrate	16,954	10,297	Sweden 7,503; Morocco 1,613.
Metal including alloys:			
Scrap	2,162	17,551	West Germany 13,530; France 1,577.
Unwrought	64,660	24,868	West Germany 12,900;[5] Peru 5,500;[5] Poland 3,871.
Semimanufactures	1,968	2,468	Poland 1,074; West Germany 935.
Iron and steel:			
Ore and concentrate, Fe content, thousand tons	[4]2,046	2,033	U.S.S.R. 1,531; India 300; Sweden 21.
Roasted pyrite, do.	--	26	All from Sweden.

See footnotes at end of table.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979[3]	Principal sources, 1979[3]
METALS —Continued			
Iron and steel —Continued			
Metal:[6]			
Scrap ---------- thousand tons	546	708	U.S.S.R. 394; West Germany 56; Belgium-Luxembourg 29.
Pig iron ---------- do	804	669	NA.
Ferroalloys ---------- do	22	44	Spain 1; Sweden 1.
Steel, primary forms ---------- do	1,911	2,057	West Germany 112; Belgium-Luxembourg 10.
Semimanufactures:			
Bars, rods, angles, shapes, sections ---------- do	825	719	U.S.S.R. 285;[4] Poland 106; Czechoslovakia 88.[4]
Plates and sheets ---------- do	693	636	U.S.S.R. 464;[4] Czechoslovakia 50; Bulgaria 37.
Hoop and strip ---------- do	139	204	West Germany 74; Sweden 2.
Rails and accessories ---------- do	228	218	NA.
Wire ---------- do	36	36	West Germany 8;[4] Belgium-Luxembourg 3.
Tubes, pipes, fittings[4] ---------- do	354	350	Spain 61; Poland 30; Czechoslovakia 21; West Germany 21.
Castings and forgings, rough ---------- do	9	12	West Germany 6.
Lead:			
Oxide ----------	--	25	West Germany 20.
Metal including alloys:			
Scrap ----------	1,196	754	All from West Germany.
Unwrought ----------	3,468	3,512	Yugoslavia 2,936; West Germany 400.
Semimanufactures ----------	8	5	France 4.
Magnesium metal including alloys, unwrought ----------	175	18	All from Italy.
Manganese ore and concentrate, Mn content[4] ----------	73,400	73,800	U.S.S.R. 63,700.
Mercury ---------- 76-pound flasks	5,592	5,045	Spain 3,510; Italy 1,001.
Molybdenum ore and concentrate ----------	59	33	All from Sweden.
Nickel:			
Matte and speiss ----------	144	141	All from France.
Metal including alloys:			
Scrap ----------	16	42	United Kingdom 33.
Unwrought ----------	100	--	
Semimanufactures ----------	16	27	West Germany 21.
Silver metal including platinum-group metals and alloys:			
Waste and sweepings ---------- value, thousands	--	$33	All from West Germany.
Metal, unworked or partly worked:			
Platinum-group ---------- do	$3	$830	Do.
Silver ---------- thousand troy ounces	4,148	10,818	West Germany 8,663; United Kingdom 1,768.
Tin:			
Ore and concentrate ----------	100	--	
Metal including alloys:			
Unwrought ----------	1	68	United Kingdom 65.
Semimanufactures ----------	NA	17	All from West Germany.
Titanium:			
Oxides ----------	16,751	21,502	Yugoslavia 11,592; West Germany 5,217; Finland 4,295.[4]
Metal including alloys, all forms ----------	--	6	All from Japan.
Tungsten:			
Ore and concentrate ----------	40	[7]22	All from Netherlands.
Metal including alloys, all forms ---------- kilograms	--	4	All from Switzerland.
Zinc:			
Ore and concentrate ----------	650	15,957	All from Sweden.
Oxide and peroxide ----------	12	195	France 134; West Germany 61.
Metal including alloys:			
Unwrought[5] ----------	[r]2,800	11,300	Norway 2,000; West Germany 1,638; Peru 1,500.[5]
Semimanufactures ----------	[7]210	205	West Germany 114; Italy 56; Yugoslavia 21.
Other:			
Ores and concentrates, n.e.s ----------	4,095	18,019	All from West Germany.
Ash and residue containing nonferrous metals ----------	13,542	23,496	Spain 12,529; West Germany 10,609.
Oxides, hydroxides, peroxides, n.e.s ----------	401	2,201	West Germany 1,842; France 325.
Metals:			
Metalloids ----------	2,865	232	France 230.
Base metals including alloys, all forms, n.e.s ----------	[r 7]15,742	16,420	Yugoslavia 15,862;[4] Japan 343; West Germany 205.
NONMETALS			
Abrasives, n.e.s.:			
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	--	$142	Netherlands $127.
Grinding and polishing wheels and stones ----------	80	119	Austria 47; West Germany 26; Sweden 23.
Corundum, artificial ----------	NA	2,627	All from West Germany.
Asbestos ----------	62,600	62,000	Mainly from U.S.S.R.
Barite and witherite ----------	NA	2,810	All from West Germany.
Boron materials:			
Crude natural borates ----------	--	6,885	Turkey 6,880.
Oxide and acid ----------	4,210	4,674	France 4,673.
Cement[8] ----------	32,000	12,800	U.S.S.R. 7,000.
Chalk ----------	--	94	All from France.

See footnotes at end of table.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979[3]	Principal sources, 1979[3]
NONMETALS —Continued			
Clay and clay products:			
Crude:			
Bentonite	9,989	10,536	All from Hungary.
Fire clay	3,742	--	
Fuller's earth and chamotte	--	430	West Germany 224; Yugoslavia 206.
Kaolin[4]	47,400	15,000	United Kingdom 7,525;[4] Hungary 7,000.
Other	--	21	Austria 16.
Products:			
Refractory (including nonclay brick)	6,000	11,207	West Germany 2,523; Austria 2,345; France 1,426.
Nonrefractory	655	1,146	Sweden 315; West Germany 254; Austria 180.
Diamond:			
Gem, not set or strung -- value, thousands	$5	$17	All from Belgium-Luxembourg.
Industrial -- do	$1,857	$5,179	Belgium-Luxembourg $4,674.
Diatomite and other infusorial earth	NA	1,058	West Germany 904; France 113.
Feldspar and fluorspar	18,279	24,740	Norway 11,978; Sweden 9,242.
Fertilizer materials:			
Crude, phosphatic, P_2O_5 content[4]	460,200	544,700	U.S.S.R. 451,000.
Manufactured:			
Nitrogenous, N content[5]	38,400	12,700	NA.
Phosphatic, P_2O_5 content[4]	20,900	22,300	West Germany 21,354.
Ammonia	NA	22,064	West Germany 20,968.
Graphite, natural[4]	6,214	6,884	NA.
Gypsum and plasters	10	1,240	West Germany 1,027; France 116; Austria 96.
Iodine	--	1	All from West Germany.
Lime	--	102	Italy 76; Austria 26.
Magnesite	37,776	36,717	Czechoslovakia 33,640;[4] Turkey 2,006.
Mica, all forms[4]	1,767	1,234	India 788.
Pigments, mineral: Processed iron oxides	18	230	Italy 212.
Precious and semiprecious stones, synthetic value, thousands	$9	$3	All from Sweden.
Salt	6	--	
Sodium compounds, n.e.s.:			
Caustic soda	9,176	27,245	West Germany 27,189.
Soda ash	NA	11	All from West Germany.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	r1,419	6,744	Yugoslavia 4,040; West Germany 2,650.
Worked	r962	281	Italy 122; Spain 64; Yugoslavia 46.
Gravel and crushed rock	3,485	12,664	West Germany 5,700; Hungary 5,206.
Limestone	NA	145	All from West Germany.
Quartz and quartzite	22	262	Brazil 250.
Sand	997	2,138	Netherlands 1,930; Italy 137.
Sand and gravel[9]	NA	152,466	All from West Germany.
Sulfur:			
Elemental, other than colloidal	168,800	178,238	Poland 174,700.[4]
S content of unroasted pyrite[4]	39,200	8,200	Mainly from U.S.S.R.
Sulfuric acid[8]	65,300	41,300	NA.
Talc	1,012	2,612	Austria 940; Egypt 940; West Germany 725.
Other:			
Crude	23,738	28,758	Hungary 28,718.
Slag, dross, and similar waste, not metal-bearing	47,164	5,749	Sweden 5,654.
Halogens	54,438	32,643	Sweden 20,359; West Germany 12,060.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	62	91	Yugoslavia 40; Italy 28; Austria 23.
Carbon black	24,934	36,854	U.S.S.R. 23,029; West Germany 13,570.
Coal and briquets:			
Anthracite and bituminous coal[4] thousand tons	5,936	8,657	U.S.S.R. 4,456; Poland 1,925; Czechoslovakia 745.
Lignite and lignite briquets -- do	3,332	3,015	Poland 2,974.
Coke and semicoke[4] -- do	2,596	2,961	U.S.S.R. 903; Czechoslovakia 795; Poland 457.
Gas, natural[4] million cubic feet	r125,403	152,919	Mainly from U.S.S.R.
Petroleum: Crude and partly refined[4] thousand 42-gallon barrels	146,480	152,065	U.S.S.R. 136,240; Iraq 8,161; Syria 1,860.
Refinery products:			
Gasoline -- do	7	28	West Germany 12; Belgium-Luxembourg 10.
Kerosine -- do	28	51	Hungary 41; Italy 6.
Distillate fuel oil -- do	129	163	Italy 152.
Residual fuel oil[8] -- do	166	182	NA.
Lubricants[8] -- do	187	188	NA.
Other:			
Liquefied petroleum gas 42-gallon barrels	81	5,058	West Germany 5,050.
Mineral jelly and wax -- do	55	79	All from Netherlands.
Nonlubricating oils -- do	NA	1,071	All from West Germany.
Petroleum coke -- do	NA	114,802	West Germany 112,327.

See footnotes at end of table.

Table 3.—German Democratic Republic: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979[3]	Principal sources, 1979[3]
MINERAL FUELS AND RELATED MATERIALS —Continued			
Refinery products —Continued			
Other —Continued			
Bitumen and other residues 42-gallon barrels	1,091	1,915	France 1,224; Sweden 691.
Bituminous mixtures do	430	1,079	Austria 448; Netherlands 285; Italy 224.
Unspecified[8] thousand 42-gallon barrels	510	648	Poland 445; Romania 125.[4]
Mineral tar and other coal-, petroleum-, or gas-derived chemicals	43,540	39,429	U.S.S.R. 35,450; West Germany 3,972.

[r]Revised. NA Not available.

[1]Owing to the lack of official trade data published by the German Democratic Republic, this table should not be taken as a complete presentation of the German Democratic Republic's mineral imports. These data have been compiled from various sources which include United Nations information, data published by the trading partners, and partial official trade sources of the German Democratic Republic.

[2]Unless otherwise specified, data are compiled from the offical trade statistics of individual trading partners.

[3]Unless otherwise specified, data for West Germany are from official trade statistics of the Federal Republic of Germany, for January-September 1979 only.

[4]Official trade statistics of the German Democratic Republic.

[5]World Bureau of Metal Statistics, World Metal Statistics, London.

[6]United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[7]Data incomplete; tonnage not available for all sources.

[8]Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow.

[9]As reported in the Federal Republic of Germany's trade statistics, it is unclear how this grouping fits into the "Sand" and "Gravel and crushed rock" categories reported above, so it has been reported separately.

COMMODITY REVIEW

METALS

The GDR does not have adequate resources of most metals. The country has economic reserves of metals such as copper, nickel, and tin, but does not have sufficient quantities to cover domestic needs. For metals such as lead, zinc, tungsten, antimony, and iron ore, the mines are depleted, and the metals can only be recovered at high costs. For a number of other metals such as cobalt, chrome, and manganese, the GDR lacks reserves and does not expect to discover any.

Due to its poor resource base, the GDR is attempting to utilize all means to increase its production of metals. A large campaign is underway to recycle metals and to recover metals wasted in production processes. For example, at the Mansfeld firm's Hettstedt Copper-Silver smelter, between 1981 and 1985, plans are to produce annually 600 tons of zinc, 250 tons of lead, 50 tons of copper, and 30 tons of tin from previously unused flue dust. Secondary materials are an important source for the production of ferrous and nonferrous metals and for practically all precious metals. Furthermore, the GDR is conducting geological explorations to expand its base of copper, tin, zinc, and tungsten.

In 1980, the GDR increased its production of crude steel, while its output of most nonferrous metals either increased slightly or remained at the previous level, except for cadmium for which production declined. Because the GDR does not report production for nonferrous metals, production figures are estimates. Occasionally, however, the GDR publishes some types of information regarding nonferrous metals production. For example, the GDR reported that in 1978 it produced the following amounts of semimanufactures: Aluminum—173,250 tons; copper—70,035 tons; tin—1,487 tons; and zinc—20,552 tons.

Aluminum.—In 1980, aluminum production remained at the same level. The GDR is entirely dependent upon imported bauxite which it obtains mainly from Hungary and Yugoslavia. Because of the energy-intensive nature of aluminum production, the GDR is attempting to minimize the use of aluminum in materials used in construction, although aluminum is still being substituted for copper in the production of electric wire and cables. At present, 65% of electric wire and cable is made from aluminum.

In 1980, installation was completed at the VEB Aluminum Foil Rolling enterprise in Merseburg of an aluminum foil rolling mill

purchased from the French Secim Co. The Merseburg enterprise receives wide aluminum strips from the Nachterstedt Light Metals plant, which it can roll to a thickness of 0.007 millimeter for use in the production of condensers. The new equipment will enable the Merseburg plant to produce 1,600-millimeter-wide foil at a rate of 2,000 meters per minute. To make better use of secondary materials, the GDR constructed a new treatment plant in Rackwitz for household aluminum waste.

Copper.—In 1980, copper output remained the same although mining conditions are increasingly more difficult. The VEB Wilhelm Pieck firm in Mansfeld administers all copper industry enterprises. The Mansfeld firm is one of the main concerns administering nonferrous mining and metallurgy. It employs approximately 46,000 workers, and produces copper, aluminum, and other nonferrous metals.

The Mansfeld firm has not conducted mining at the Eisleben or Mansfeld Mines for many years, and copper is now mined at the Allstedt and Sangerhausen Mines. The former mines have been turned into various types of enterprises. For example, the former Thaelman Mine now contains a division of the Mansfeld firm developing means for the rationalization of production.

In the summer of 1980, the Mansfeld firm put into operation a copper wire mill at the Hettstedt Copper-Silver smelter that can cast wire directly from molten copper. In addition, the Soviet Union is scheduled to supply the Hettstedt smelter with a press with a force of 3,150 tons for the manufacture of copper blanks.

Iron and Steel.—Crude steel output rose again in 1980. However, the GDR's reserves of iron ore are almost depleted, and there have not been advances in the production of iron ore and pig iron similar to those for steel. The GDR is continuing to expand its steel industry although demand is still exceeding production. The country was able to supply 74% of its demand for rolled steel, while the remainder was imported mainly from the Soviet Union. Demand for rolled steel increased in 1980 to 11 million tons.

There have been a number of improvements in steel production capabilities. In September 1979, a pipe extrusion facility began continuous operations at Zeithain near Riesa, with an annual capacity of 190,000 tons per year. This new facility manufactures seamless low-alloy or alloy-less pipes, with an external diameter of 20 to 89 millimeters and a wall thickness of 2 to 6.5 millimeters. The new pipe extrusion facility should reach full capacity in 1981. Yugoslavian and Czechoslovakian enterprises participated in building and equipping this facility.

At the VEB Qualitaet und Edelstahl firm in Brandenburg, a new electrosteel works began operations with two electric arc furnaces and continuous billet casting. The new works has a capacity of 550,000 tons per year, and was constructed by the Italian firm Danieli C. S.p.A. There are additional plans to startup a new continuous wire mill at the Brandenburg firm in 1981.

Other new projects underway include a plate mill ordered for the Ilsenburg Enterprise from Austria's Voest-Alpine AG as consortium leader, in conjunction with the FRG's Schloemann-Siemag AG. A new section mill to be installed at Saalfeld was ordered by the VEB Maxhuette Unterwellenborn from a consortium led by the Belgium steelmaker Cockerill S.A. Japan's Nissho-Iwai Co., Ltd., and Komatsu Ltd. have contracted to supply the GDR with a new steel foundry, with a capacity of 15,400 tons of castings per year for the coal mining industry. The foundry will be located in Bosdorf, north of Berlin, and the estimated value of the contract is $32 million. At the VEB Bandstahlkombinat Eisenhuettenstadt Ost, Austria's Voest-Alpine AG expects to start construction of a 2.5-million-ton-per-year melting shop with continuous casting for blooms and slabs. Construction is to begin after the scheduled contract signing in 1981 and is to take 3 1/2 years. Voest-Alpine AG will subcontract some of the work to the FRG's Friedrich Krupp-Huettenwerke and the Salzgitter AG.

In the way of advanced technology, the GDR has in operation two plasma furnaces at the VEB Edelstahlwerk in Freital which produce stainless steel from scrap. The plasma system generates temperatures of more than 15,000° C and is said to offer high recovery rates of alloys with iron losses below 2%. Voest-Alpine AG is newly licensed to make and market these furnaces.

Lead and Zinc.—Although the mining of lead and zinc has almost ceased, the GDR is able to maintain production or achieve increases in its metal production. The country is attempting to reduce its heavy dependence on imports by increasing output

from secondary materials. Perspective development depends on increasing the recovery of lead along with precious metals from scrap and on increasing the production of lead from battery scrap.

To increase secondary production of lead, a rotary furnace and a new lead remelting complex, with a capacity of 100,000 tons per year, will be constructed at the Muldenhuetten site of the VEB Bergbau und Huettenkombinat Albert Funk in Freiberg. The Italian Snam Progetti S.p.A. subsidiary of Ente Nazionale Idrocarburi (ENI) has a $90 million contract for the construction of the remelting complex, and the British firm Imperial Smelting Processes Ltd. is subcontracting for planning the smelting and refining sections. The Freiberg firm's present lead smelter is the only lead smelter in the GDR. It smelts secondary materials and has a capacity of 40,000 tons per year.

The GDR reported increased production of zinc for the first half of 1980. From 1981 through 1985, the country plans to produce 600 additional tons of zinc annually from flue dust at the Hettstedt smelter of the Mansfeld firm.

Nickel.—Nickel production in 1980 remained the same. Although the GDR has some economic reserves of nickel, it must rely on imports to meet its domestic needs.

Silver.—Silver production did not change significantly in 1980. Silver is obtained as a byproduct of other nonferrous operations or is recovered from secondary materials.

Tin.—The GDR has shown a significant increase in the production of tin during the past 5 years, but indications are that tin production did not increase in 1980. Although the GDR is still importing tin, it is attempting to become self-sufficient. The GDR claims it has large reserves of tin ore, but the majority of this ore is in a fine coalesced form and is difficult to concentrate using the usual "wet mechanical" processes. A new concentration technology has been developed that is being used on tin ore from the Altenberg Mine and is enabling the GDR to increase output. In addition, new smelting installations have been put into operation, and plans call for an intensification of smelting processes at the Freiberg firm.

NONMETALS

The GDR produces a variety of nonmetallic minerals for agricultural, industrial, construction, and other uses. It also produces some nonmetals such as potash, limestone, gravel, building sand, fluorspar, kaolin, and salt in quantities great enough to provide for its domestic needs and for export. However, the GDR produces insufficient quantities of other nonmetals such as pyrites and special clays, and is almost entirely dependent on imports for other important nonmetals such as phosphate raw materials and asbestos.

Practically all building materials are extracted from surface mines. There are more than 1,000 of these surface mines that range in production from 1,000 tons per year for some small grit mines to 4 to 6 million tons per year for mines for the cement industry. An important source of nonmetals that is not being adequately exploited is the overburden from lignite mines. Gravel, sand, and kaolin are found in large quantities in this overburden, and future plans are to increase the percentage of all minerals recovered from overburden. The most significant nonmetallic mineral produced is potash, which is one of the GDR's major exports.

Clays.—A number of clay deposits are becoming depleted or more difficult to mine. Even kaolin, which is produced in considerable quantity, is now being mined under more difficult conditions and is of a lesser quality.[5] Some clay deposits which have special properties have been depleted. For example, up until 1979 a special clay was being mined south of Osterfeld in the Zeits region (Kreis) that was the most valuable domestic raw material for the red or "flaming" slabs produced at the VEB Kurt Buerger Slab Enterprise. This clay must now be imported from Poland.

Fluorspar.—The country produces sufficient quantities of fluorspar to supply its needs and for export. Fluorspar production is administered by the VEB Potash (Kali) firm which contains plants producing fluorspar and barite. The existence is reported of four fluorspar and barite plants that employ 2,500 workers.

Gravel and Sand.—The production of gravel and building sand has been continually increasing. The GDR exports large amounts of gravel and sand. The Halle district (Bezirk) is the largest gravel and sand producing district. It contains over 90 gravel and sand deposits that supply approximately 14% of the gravel and sand in the GDR. The GDR has sufficient gravel and sand for supplying the construction industry and other uses beyond the year

2000.

Lime and Dead-Burned Dolomite.—The GDR has been experiencing an increasing demand for lime and dead-burned dolomite. Lime is among the few mineral commodities for which the GDR is an exporter. Plans are to increase yearly production of limestone mines to 4 to 6 million tons per year. New equipment is being used to increase production. For example, the Caaschwitz surface mine near Gera has begun using a Soviet shovel, with a bucket capacity of 10 cubic meters, to mine magnesian limestone to produce dolomite. The magnesian limestone from this mine is sent to the Wuenschendorf plant where it is made into sinter dolomite for use as refractory material for steel mills and foundries.

Potash.—In 1980, potash production again increased. The VEB Potash firm (VEB Kombinat Kali) administers the entire GDR production of potash, rock salt, and spar. This firm, which contains seven enterprises with their subordinate mines and plants, employs approximately 32,000 workers, of which approximately 22,000 are engaged in the production of potash. VEB Potash's fixed assets are valued at approximately M5 billion. The production of potash is concentrated at the Sued-Harz, Werra, and Zeilitz enterprises, while the other enterprises produce primarily salt products, fluorspar, and barite.

The GDR is the world's third largest producer of potash following the U.S.S.R. and Canada and is the world's second largest exporter of potash after Canada. Approximately 85% of GDR potash production is exported. Exports go to over 50 countries, including all the CMEA countries, except the U.S.S.R. Hungary, Czechoslovakia, and Poland are particularly large importers among the centrally planned economy countries.

The Minister for Mining, Metallurgy, and Potash, Dr. Kurt Singhuber, stated that present potash reserves are sufficient through the year 2010. Mining conditions, however, are becoming more difficult and costly. Large increases in production are not foreseen in the near future. During the first half of 1979, and also in 1980, additional capacities were put into operation at the Werra enterprise's Merkers plant. In 1981, a new compaction unit is to be put into operation at the Zeilitz enterprise, which will provide customers with a wider range of grades.

Rock Salt.—The production of rock salt has been steadily increasing, and the GDR is an exporter of rock salt. Practically all rock salt is produced at the Bernburg Rock Salt plant which is subordinate to the VEB Potash.

MINERAL FUELS

The GDR produces small amounts of natural gas, a very small amount of petroleum, and has discontinued mining of bituminous coal. The major mineral energy resource that the GDR has in abundance is lignite. Owing to the increased cost of petroleum and the uncertainty of increased supply, the country is planning to rely even more heavily on domestic lignite as a primary energy resource. The GDR is planning to substitute lignite for petroleum wherever possible as a fuel and in petrochemical production.

Despite the fact that the country has been seriously affected by the increase in petroleum prices, it is not as dependent on petroleum as some other industrial countries. In 1980, petroleum comprised approximately 21% of the GDR's primary energy balance, while lignite comprised approximately 58%. (See table 4.) Thus the GDR's lignite production, along with its production of other energy sources such as natural gas, makes it less dependent on imports than, for example, the FRG, which supplied only 40% of its primary energy needs from domestic production.

In 1980, reliance on natural gas as a primary energy source increased as imports from the Soviet Union rose sharply. Natural gas in 1980 comprised approximately 14% of primary energy consumption. Because imports of natural gas from the Soviet Union will not increase during 1981-85, and the GDR's own production of natural gas has stabilized, the GDR's reliance on natural gas should not rise much over the 1980 level, barring any significant discoveries.

Although lignite is to be the principle energy resource for electric power production, the GDR is also promoting its nuclear power program as quickly as possible. Lignite fuel is the source for approximately 80% of the electric energy produced, while nuclear power comprised approximately 11% in 1980. The Minister for Coal and Energy, Wolfgang Mitzinger, stated that solar, wind, and water power will not play a role in electric power generation due to the GDR's geographic location.[6]

Lignite will continue to be the primary

fuel for electric power generation. New lignite-fired powerplants will be opened, and capacities will be increased at existing plants. In 1980, construction on the Jaenschwalde powerplant was conducted. It is to be supplied with lignite fuel from expanded mining operations in the Cottbus district (Bezirk).

Table 4.—German Democratic Republic: Primary energy balance for 1979 and 1980

(Million tons of standard coal equivalent)[1]

Year	Total primary energy	Coal (lignite, brown, bituminous)	Crude oil and petroleum products	Natural and associated gas	Hydroelectric power	Nuclear power
1979:[r]						
Production[2]	97.2	84.5	0.1	11.4	0.2	1.0
Exports	.8	.7	--	--	.1	--
Imports	46.1	9.7	30.4	5.8	.2	--
Apparent consumption	142.5	93.5	30.5	17.2	.3	1.0
1980:						
Production[2]	98.1	85.3	.1	11.4	.2	1.1
Exports	.8	.7	--	--	.1	--
Imports	49.8	9.7	31.2	8.7	.2	--
Apparent consumption	147.1	94.3	31.3	20.1	.3	1.1

[r]Revised.

[1]One ton standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used follow: Hard coal, 1.0; lignite and brown coal, 0.33; crude oil, 1.47; natural gas, 1.33 (per 1,000 cubic meters); and hydroelectric and nuclear power, 0.123 (per 1,000 kilowatt-hours).

[2]Production is taken from production table.

Coal.—In 1980, production of lignite increased to approximately 258 million tons, and plans call for production to reach 261.1 million tons in 1981. Long-term plans call for lignite production to reach 300 million tons by 1990. According to 1980 GDR reports, the country is extracting lignite from 28 surface mines.[7] In 1979, the GDR reported that lignite was being extracted from 32 surface mines, 3 of which were in the running-down and 2 of which were in the starting-up stages. Indications are that mines have not opened up at a rate greater than they are closing down, although production is increasing. During the 1980's, 11 surface mines will be depleted, and 16 are scheduled to commence operation, although earlier reports stated that 21 new mines were to commence operations in the 1980's.[8]

In 1975, lignite resources were estimated at 47.6 billion tons. Of these, 18 to 20 billion tons are economic reserves.[9] Approximately 45% of the economic reserves are in fields containing more than 250 million tons, while 55% are in smaller fields, of which there are 77 fields with less than 100 million tons. In the future, the GDR will have to depend more on smaller fields despite the negative economic effects. There are also a number of deeper lignite seams not classified as economic reserves that the GDR will have to resort to after the year 2000.

During the first half of 1980, additional mining facilities were put into operation at the Groitsches-Dreieck and the Delitzsch-Suedwest surface mines in the Leipzig district. These new mining facilities can make-up in some measure for production shortages at the Borna coal mining enterprise in the Leipzig district. The Borna enterprise, which supplied approximately 112,000 tons daily in 1980, did not meet its production goals, especially at Borna's large Espenhain surface mine. The largest lignite mine in the GDR is the Nochten surface mine in the Cottbus district, which supplies lignite primarily to the newly expanded Boxberg powerplant. It also supplies the VEB Schwarze Pumpe Gaskombinat (Gas Manufacturing complex) and a number of briquet plants. The Nochten Mine in 1980 produced a record output of 24 million tons and has sufficient reserves until approximately the year 2020.

The GDR plans to equip its new surface mines with high-capacity machinery. This is to include mobile haulage bridge assemblies with an output of 450,000 cubic meters per day and rotary excavators, with a capacity of 150,000 to 200,000 cubic meters per day. These machines, along with belt conveyors, are to predominate beyond the year 1990.

Although the supply of lignite briquets is continuing to increase, it is not increasing

at a rate adequate to meet demand. It will be necessary for the GDR to expand its lignite briquet production facilities. Lignite briquets are now being used by a number of industries as a substitute for hard coal, the mining of which has stopped because of the depletion of existing mines. The country now depends entirely on imports for hard coal. The demand for high-temperature lignite coke has continued to increase. Production of high-temperature lignite coke has expanded with the addition of a new oven unit, with a capacity of 700,000 tons at the Schwarze Pumpe Gaskombinat in the Cottbus district. A large percentage of the production of high-temperature lignite coke, hard coke, and lignite briquets occurs at the Schwarze Pumpe complex which produces approximately 65% of the hard coal coke, 50% of the high-temperature lignite coke, and 20% of the lignite briquets in the GDR.

Because of the shortage of lignite briquets, coke, and bituminous coal, ways are being sought to replace these products with raw lignite wherever possible.

Natural Gas and Petroleum.—The increased supply of natural gas from the Soviet Union, along with the GDR's own production of natural gas, has somewhat alleviated the energy supply situation. Since the GDR's production of natural gas has stabilized, and imports from the Soviet Union are planned to remain at their 1980 level of 6.5 billion cubic meters annually, consumption of natural gas should not greatly increase. The GDR plans to more effectively utilize gas for domestic purposes and in industry, and to increase its gas storage capacity.

In addition, the GDR has been increasing its production of manufactured gas. This is in keeping with the GDR's long-term strategy of relying on domestic lignite. There are 14 gas manufacturing plants in the GDR, 4 of which produce 90% of the total output. The largest of these, the VEB Schwarze Pumpe Gaskombinat, produces 75% of the total output.

As part of its effort to conserve petroleum, the GDR plans to better utilize petroleum through more efficient cracking. At present, 40% of petroleum is utilized in fuel uses for which lignite can be substituted. In accordance with these plans to change the refinery mix, the petroleum refinery at the Schwedt Petrochemical complex is adding a large amount of equipment to produce the more valuable petroleum components. Improvements in petroleum refining to upgrade the product mix are occurring at the VEB Walter Ulbricht Leuna enterprise and are to be completed in the mid-1980's.

Nuclear Power.—The GDR, with Soviet assistance, has developed its nuclear power industry, and with Soviet assistance is planning to construct a nuclear powerplant at Stendal, approximately 100 kilometers from Berlin in the Magdeburg district. The GDR originally intended by 1985 to double its nuclear power capacity which is under the administration of the Bruno Leuschner Nuclear Powerfirm based in Greifswald. However, plans have been revised to have nuclear power increased from its current 11% of electric power generation to only 12% to 14% by 1985.

The GDR produces uranium with which it can expand its nuclear power generation. However, the uranium is produced by the joint Soviet-GDR stock company, SDAG Wismut, and must first be delivered to the Soviet Union. The Soviet Union then supplies the GDR with enriched uranium rods, which the Soviet Union later repossesses for reprocessing.[10]

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[1]Foreign mineral specialist, Branch of Foreign Data.

[2]CMEA is the Council for Mutual Economic Assistance. It is comprised of Bulgaria, Cuba, Czechoslovakia, German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia has associate status with limited participation, but is normally not included for statistical purposes.

[3]The GDR mark (M) is a nonconvertible currency officially pegged at 1:1 with the Federal Republic of Germany's mark (DM). The GDR mark's relation to the dollar fluctuates with the dollar/DM exchange rate. Foreign trade figures are denoted in an accounting unit known as the valuta mark (VM). The rate of dollars to valuta marks is US$1.00=3.11VM.

[4]US-GDR Trade Trends, January-December 1979, U.S. Department of Commerce, International Trade Administration, March 1980, p. 16.

[5]Neue Bergbautechnik (New Mining Technology), Leipzig, v. 10, October 1980, p. 553.

[6]Neues Deutschland, East Berlin, Jan. 17-18, 1981, p. 1.

[7]Neue Bergbautechnik (New Mining Technology), Leipzig, v. 10, October 1980, p. 550. Die Wirtschaft (The Economy), East Berlin, No. 7, 1980, p. 16.

[8]Neues Deutschland, East Berlin, Jan. 24-25, 1980, p. 3.

[9]Neues Deutschland, East Berlin, June 4, 1980, p. 2.

[10]DIW Wochenbericht (The Weekly Report), West Berlin, Jan. 29, 1981, pp. 60-61.

The Mineral Industry of the Federal Republic of Germany

By Joseph B. Huvos[1]

In 1980, the Federal Republic of Germany (FRG) remained one of the world's major processors and consumers of minerals, most of which were imported. There was, however, a plentiful supply of domestic coal, potash, and salt. National efforts were focused on securing and expanding raw material supply by encouraging development of domestic resources, concluding diversified trade agreements, and encouraging foreign exploration, development, and operations. Private industry was assisted by Government guarantees, loans, and favorable tax rates.

In mid-1980, the FRG economy reached a cyclical turning point. Following a strong expansion that lasted for 2 years, the economy turned sharply downward in the second quarter and remained stagnant past the end of the year. The growth of the economy in real terms was only about 2%. In 1980, FRG's gross national product was about $759 billion.[2] Contribution of the individual sectors of the mining and minerals-processing industry to the gross national product and employment in 1979 and 1980 are shown in the following tabulation:

	Contribution to gross national product (million dollars)[1]		Employment at end of 1980 (thousand persons)
	1979	1980[p]	
Coal mining	11,818	12,709	207
Stones and earths	15,033	15,808	193
Iron and steel	24,164	25,093	284
Nonferrous metals	11,262	13,399	80
Chemicals including petroleum	66,670	66,911	568
Total	128,947	133,920	1,332

[p]Preliminary.
[1]Does not include value added tax.

Source: Adapted from Statistisches Bundesamt, Wiesbaden. Wirtschaft und Statistik, No. 2, 1981, p. 87.

Several events were noted in 1980 in the minerals industry. Significant new plants commissioned included the first stage of the Töging aluminum plant of the Vereinigte Aluminium Werke AG (VAW), a ministeelworks of the Thyssen Niederrhein AG at Oberhausen, and a direct-reduction steel plant of the Norddeutsche Ferrowerke in Hamburg. All forging activities of the Krupp Group were consolidated in Essen and Bochum. Grafitwerk Kropfmühl expanded the capacity of its Kropfmühl Mine in Bavaria.

PRODUCTION

In 1980, there was a modest increase in the production of mineral commodities in the FRG. Production for the last 5 years, including 1980, is shown in table 1.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite, gross weight	221	28	280	349	--
Alumina thousand tons	1,333	1,454	1,410	1,352	1,422
Metal:					
Primary do	697	742	740	741	731
Secondary:					
Alloyed do	305	347	368	381	368
Unalloyed do	42	45	47	45	40
Bismuth:					
Ore and concentrate[e]	11	11	9	10	10
Metal, smelter	500	700	600	661	NA
Cadmium metal, smelter	1,275	1,336	1,182	1,266	1,194
Cobalt metal, smelter	384	400	350	385	400
Copper:					
Mine output, metal content	1,613	1,210	821	861	1,274
Metal:					
Blister and anodes:					
Primary	193,695	r189,600	165,800	158,200	165,800
Secondary	50,805	58,407	55,700	92,500	92,000
Total	244,500	248,007	221,500	250,700	257,800
Refined, including secondary:					
Electrolytic	285,581	r340,709	318,551	303,122	302,516
Fire refined	161,000	r99,451	84,881	79,396	71,261
Total	446,581	440,160	403,432	382,518	373,777
Gold:					
Mine output, metal content troy ounces	2,456	2,392	2,119	2,357	e2,400
Metal, including secondary do	346,874	319,803	336,264	293,857	298,873
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	2,256	2,470	1,597	1,649	1,948
Iron content do	750	816	510	526	597
Metal:					
Pig iron do	31,538	r28,697	29,861	34,855	33,609
Blast furnace ferromanganese and spiegeleisen do	220	175	209	233	200
Blast furnace ferrosilicon do	91	87	78	79	64
Electric furnace ferroalloys do	239	210	139	195	182
Steel ingots and castings do	42,415	38,985	41,253	46,040	43,838
Semimanufactures do	29,793	28,758	30,198	32,813	31,661
Lead:					
Mine output, metal content	r30,733	r30,468	23,181	25,227	23,063
Metal:					
Primary	r186,300	r182,900	189,900	194,800	191,109
Secondary	r151,100	r190,600	179,100	178,500	159,200
Total	337,400	373,500	369,000	373,300	350,309
Magnesium metal including alloys:					
Unwrought (secondary only)[e]	500	600	600	600	600
Castings	r17,699	r16,360	16,359	15,999	15,102
Mercury (secondary only) 76-pound flasks	3,191	e3,200	2,437	2,639	1,624
Molybdenum metal	227	NA	NA	NA	NA
Nickel metal, including secondary[2]	130	91	901	1,223	1,235
Platinum troy ounces	2,283	e4,820	2,572	2,400	NA
Silver:					
Mine output, metal content thousand troy ounces	1,026	1,061	799	1,039	1,038
Metal, including secondary do	23,497	18,004	18,085	16,291	24,371
Tin metal, including secondary	1,449	3,940	4,767	4,096	2,257
Tungsten metal	1,563	e1,400	e1,500	NA	NA
Zinc:					
Mine output, metal content, recoverable	r111,247	r111,384	97,405	96,853	99,720
Metal, unwrought, unalloyed:					
Primary	283,359	335,127	288,679	333,665	342,797
Secondary	21,395	19,653	18,157	21,858	22,406
Total	304,754	354,780	306,836	355,523	365,203
NONMETALS					
Abrasives: Artificial corundum	83,196	93,646	96,737	102,212	102,222
Barite	262,387	265,593	168,586	161,661	175,380
Bromine	4,154	3,736	3,893	4,020	e4,000
Cement and clinker:					
Cement (excluding clinker) thousand tons	33,281	32,163	33,959	35,287	34,186
Clinker do	2,136	1,245	1,344	1,377	1,360

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Clays:					
Fire clay (exclusive of klebsand) _ thousand tons__	5,056	5,276	5,224	5,635	[e]5,600
Kaolin, marketable _____ do____	[r]442	[r]500	521	556	[e]600
Bleaching _____ do____	628	642	621	639	[e]600
Other (schieferton) _____ do____	108	129	128	124	[e]120
Diatomite and similar earth, marketable _____	52,948	49,457	47,600	43,271	[e]40,000
Feldspar, marketable _____	419,976	393,793	385,590	372,754	[e]370,000
Fluorspar, marketable:					
Acid-grade[e] _____	57,789	75,375	68,150	56,855	[e]56,700
Metallurgical-grade[e] _____	6,421	8,375	[r]7,572	6,317	[e]6,300
Total _____	64,210	83,750	75,722	63,172	[e]63,000
Graphite:					
Crude _____	19,101	16,653	12,763	7,342	[e]7,200
Marketable[e 3] _____	[r]9,551	[r]8,326	[r]6,381	3,671	3,600
Gypsum and anhydrite, marketable _ thousand tons__	[r]2,100	[r]2,218	2,238	2,251	[e]2,340
Lime (hydrated), quicklime, dead-burned dolomite do____	9,426	8,770	8,990	9,230	9,000
Nitrogen, N content of ammonia _____ do____	1,863	1,989	1,955	2,161	2,044
Phosphates:					
Phosphate rock (including apatite), gross weight do____	86	80	__	__	__
Thomas slag-based fertilizer, P_2O_5 content _do____	167	134	150	145	161
Pigments, mineral, natural _____	22,840	26,421	21,475	28,561	[e]28,000
Potash, K_2O equivalent:					
Crude, marketable _____ thousand tons__	70	76	72	74	76
Chemically processed _____ do____	1,966	2,265	2,398	2,542	2,661
Total _____ do____	2,036	2,341	2,470	2,616	2,737
Pumice:					
Crude and washed _____ do____	3,689	3,137	3,552	2,640	2,102
Marketable _____ do____	2,197	1,749	2,087	1,432	807
Pyrite, marketable concentrate, gross weight _do____	523	531	502	460	[e]450
Quartz, quartzite, glass sand:					
Quartzite _____ do____	372	425	411	426	426
Quartz sand, ground _____ do____	418	407	421	454	453
Quartz sand, unground and glass sand____ do____	6,111	6,737	7,026	7,417	7,475
Salt, marketable:					
Rock _____ do____	6,375	7,131	6,846	8,960	[e]6,900
Marine and other _____ do____	4,942	5,192	5,812	6,130	[e]6,100
Sodium compounds, n.e.s.:					
Sodium carbonate _____	1,363,528	1,350,543	1,229,722	1,400,922	1,411,110
Sodium sulfate _____	256,677	242,247	211,000	210,664	[e]201,000
Stone, sand and gravel, n.e.s.:					
Dimension stone _____ thousand cubic meters__	194	215	307	311	264
Limestone, industrial _____ thousand tons__	52,615	48,953	50,995	54,521	53,477
Crushed and broken stone _____ do____	102,215	110,718	118,096	126,463	117,610
Slate[4] _____ do____	2	2	3	4	4
Basalt lava and lava sand _____ do____	5,922	6,623	7,047	8,056	NA
Calcite _____ do____	4	9	12	8	NA
Grinding stone _____ cubic meters__	48	63	238	71	43
Tuff _____ thousand tons__	3	2	3	3	NA
Sand and gravel _____ do____	155,010	170,425	184,786	198,637	190,255
Sulfur:					
S content of pyrite _____ do____	233	235	221	203	[e]198
Byproduct:					
Of metallurgy _____ do____	390	385	380	450	[e]450
Of natural gas _____ do____	460	631	650	903	[e]900
Of petroleum _____ do____	119	186	190		
Unspecified _____ do____	161	165	160	93	[e]93
Total _____ do____	1,363	1,602	1,601	1,649	[e]1,641
Talc including talc schist _____ do____	18	16	15	15	[e]15
MINERAL FUELS AND RELATED MATERIALS					
Carbon black _____	292,322	301,678	297,509	340,629	353,568
Coal:					
Anthracite _____ thousand tons__	6,628	6,067	6,942	7,018	87,146
Bituminous coal _____ do____	82,641	78,773	76,994	79,301	

See footnotes at end of table.

Table 1.—Federal Republic of Germany: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coal —Continued					
Lignite thousand tons	134,493	122,920	123,559	130,579	129,833
Total do	223,762	207,760	207,495	216,898	216,979
Coke:					
Metallurgical do	31,951	27,499	25,455	26,501	28,494
Gashouse do	971	809	782	937	[e]900
Total do	32,922	28,308	26,237	27,438	29,394
Fuel briquets:					
Of anthracite and bituminous coal do	1,357	1,305	1,453	1,673	1,455
Of lignite do	4,390	4,104	3,889	4,752	4,446
Gas:					
Manufactured (excluding that from petroleum refineries):[5]					
Blast furnace million cubic feet	201,399	174,312	179,857	212,629	199,456
Coke oven[6] do	263,517	223,294	205,848	214,324	226,366
Other do	76,915	70,735	72,818	52,760	[e]53,000
Total do	541,831	468,341	458,523	479,713	478,822
Natural:					
Gross do	665,537	678,565	738,002	743,900	671,223
Marketable do	658,050	637,578	707,156	[e]725,000	[e]665,000
Peat:					
Agricultural use thousand tons	1,707	1,911	2,047	1,849	1,734
Fuel use do	227	221	228	230	279
Petroleum:					
Crude thousand 42-gallon barrels	39,902	39,021	36,541	34,482	33,450
Refinery products:					
Gasoline, motor do	147,439	123,479	127,069	182,800	182,296
Jet fuel (including aviation gasoline) do	10,799	10,099	10,620	10,345	10,506
Kerosine do	378	456	334	523	315
Distillate fuel oil do	301,929	293,903	292,020	345,621	311,192
Residual fuel oil do	158,397	143,004	160,047	146,333	128,509
Lubricants do	9,081	6,763	6,653	9,660	9,080
Other:					
Liquefied petroleum gas do	32,680	38,741	37,932	36,669	30,938
Bitumen do	23,063	22,421	22,866	23,756	20,406
Unspecified do	98,534	86,999	[e]76,555	97,846	89,758
Refinery fuel and losses do	38,230	46,253	54,362	99,807	91,557
Total do	820,530	772,118	788,458	953,360	874,557

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 3, 1981.

[2]Primary nickel and nickel contained in ferronickel, Monel metal, and nickel oxide directly used by the steel industry.

[3]Series revised to reflect estimated marketable output from ores of West German origin. Total output of marketable graphite, including production from imported crude graphite, is reported as follows in metric tons: 1976—14,026; 1977—13,456; 1978—11,927; 1979—10,282; and 1980—not available.

[4]Exclusive of slate recovered from mine dumps.

[5]Natural gas equivalent is 240 kilocalories per cubic foot (8,400 kilocalories per cubic meter).

[6]Includes water gas and generator gas from coke ovens.

TRADE

In 1980, members of the European Communities remained the FRG's principal trading partners, but member countries of the Organization of Petroleum Exporting Countries were of growing importance. Considerable concern was expressed about the mounting deficit in the balance of payments, which was expected to be in the $12 billion range and was mainly a result of reliance on foreign oil and minerals.

In the U.S.-FRG trade relationship, a $2.3 billion surplus was recorded in favor of the United States, the highest ever. U.S. deliveries amounted to $14.1 billion, while the FRG exports to the United States amounted to $11.8 billion. Automobiles were the largest single item in the FRG deliveries, while machinery dominated U.S. deliveries. The FRG's mineral commodity trade in 1978-79 is shown in tables 2 and 3.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	12,260	21,621	--	Belgium-Luxembourg 7,196; France 5,828; Switzerland 3,448.
Alumina	344,606	223,954	3,748	Austria 70,557; Canada 58,368; U.S.S.R. 23,499.
Aluminum hydroxides	120,544	155,077	9,065	Sweden 44,816; Netherlands 23,187; France 19,654.
Metal including alloys:				
Scrap	52,982	51,974	--	Italy 18,756; Netherlands 13,916; France 13,267.
Unwrought	271,610	247,866	2,454	Italy 80,294; France 56,295; Netherlands 45,389.
Semimanufactures	343,982	354,116	5,819	France 74,675; United Kingdom 50,419; Netherlands 41,728.
Antimony:				
Oxides and hydroxides	319	344	--	Taiwan 51; Austria 34; Italy 30.
Metal including alloys, all forms	20	16	NA	NA.
Arsenic trioxide, pentoxide acids	82	166	NA	NA.
Beryllium metal including alloys, all forms kilograms	15	17	NA	NA.
Bismuth metal including alloys, all forms	517	407	81	United Kingdom 132; Spain 20.
Cadmium:				
Oxide and hydroxide	18	22	--	Portugal 5.
Metal including alloys, all forms	313	494	NA	NA.
Chromium:				
Chromite	3,212	8,807	--	Romania 2,924; Spain 2,042; Austria 1,360.
Oxides and hydroxides[2]	47,668	55,688	NA	NA.
Metal including alloys, all forms	125	224	47	Belgium-Luxembourg 52; Italy 29; France 20; Netherlands 20.
Cobalt:				
Oxides and hydroxides	86	45	--	Netherlands 13; Italy 10; Czechoslovakia 6.
Metal including alloys, all forms	796	847	NA	NA.
Columbium and tantalum metals including alloys, all forms:				
Columbium kilograms	19,109	41,659	--	Belgium-Luxembourg 836; Poland 198; Czechoslovakia 126.
Tantalum do.	47,122	81,307	320	United Kingdom 873; Hungary 435; Yugoslavia 278.
Copper:				
Ore and concentrate	(3)	--		
Matte	300	96	--	Sweden 52.
Sulfate	1,861	1,446	NA	NA.
Oxides and hydroxides	2,455	2,814	76	Netherlands 595; Norway 285; United Kingdom 277.
Metal including alloys:				
Scrap	53,956	54,820	90	Italy 20,794; Belgium-Luxembourg 7,291; Netherlands 6,924.
Unwrought:				
Smelter	29,589	22,384	--	United Kingdom 19,106; Belgium-Luxembourg 3,059; Iran 150.
Refined:				
Alloyed	8,064	11,152	--	Italy 4,398; France 1,659; Austria 1,299.
Unalloyed	112,695	86,686	3,925	Belgium-Luxembourg 14,983; Italy 12,631; United Kingdom 11,313.
Master alloys	1,283	1,068	--	Belgium-Luxembourg 623; France 199; Sweden 85.
Semimanufactures	319,822	357,086	33,299	Netherlands 42,941; France 40,987; Switzerland 36,023.
Gallium metal including alloys, all forms kilograms	5,600	5,400	700	Japan 2,300; Netherlands 1,000.
Germanium metal including alloys, all forms do.	400	1,300	--	United Kingdom 600; Romania 500.
Gold:				
Ash and waste value	$6,970	$1,637	NA	NA.
Scrap and sweepings do.	$164,791	$700,529	NA	Spain $670,522.
Metal including alloys:				
Unwrought thousand troy ounces	r1,423	739	2	Israel 162; Italy 120; Switzerland 75.
Partly wrought troy ounces	194,531	136,544	1,704	United Kingdom 64,494; Italy 10,224; France 9,967.
Iron and steel:				
Ore and concentrate	5,855	3,438	--	Italy 904; United Kingdom 620; Austria 546.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Roasted pyrite	184,218	236,795	--	Belgium-Luxembourg 142,050; Austria 34,668; Mexico 20,082.
Metal:				
Scrap thousand tons	2,765	2,998	--	Italy 2,093.
Pig iron including cast iron do	736	948	--	France 419; Poland 112; Italy 103.
Sponge iron, powder, shot do	57	38	2	France 8; United Kingdom 6; Belgium-Luxembourg 5.
Spiegeleisen	2,716	1,752	--	Italy 1,636.
Ferroalloys:				
Ferrochrome	31,419	27,656	2,880	Belgium-Luxembourg 9,002; France 6,964; Czechoslovakia 2,191.
Ferromanganese	49,391	95,273	25,000	Hungary 15,327; Italy 13,945; Belgium-Luxembourg 12,125.
Ferronickel	8	422	--	Italy 400.
Ferrosilicon	25,818	31,553	523	Iran 1,942; Belgium-Luxembourg 1,436; Netherlands 1,153.
Ferrosilicochrome	1,623	3,583	--	Belgium-Luxembourg 1,652; Italy 1,222.
Ferrosilicomanganese	742	3,590	--	France 2,685; Switzerland 467.
Other	13,436	16,324	1,899	Romania 2,322; Spain 1,196; Austria 1,117.
Steel, primary forms thousand tons	3,214	3,554	535	France 824; Italy 421; Belgium-Luxembourg 222; Spain 215.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	3,725	3,865	244	France 804; Netherlands 457; Belgium-Luxembourg 212.
Universals, plates, sheets do	6,345	6,581	849	France 713; Netherlands 326; United Kingdom 266; China, mainland 239.
Hoop and strip do	1,221	1,304	35	U.S.S.R. 190; France 172; Netherlands 131.
Rails and accessories do	182	237	60	Italy 39; Netherlands 31; Yugoslavia 29.
Wire do	282	335	18	France 59; Netherlands 47; Belgium-Luxembourg 31.
Tubes, pipes, fittings do	3,691	3,532	71	China, mainland 477; Netherlands 340; Czechoslovakia 187.
Castings and forgings, rough do	113	113	9	Belgium-Luxembourg 19; Netherlands 14; France 12.
Lead:				
Ore and concentrate	10	2,577	--	Bulgaria 1,380; Romania 1,196.
Oxides	11,508	10,635	127	Netherlands 5,467; Sweden 1,044; U.S.S.R. 572.
Metal including alloys:				
Scrap	16,801	18,414	--	Italy 7,315; Netherlands 6,711; Denmark 1,814.
Unwrought	106,810	107,031	1,376	Italy 43,042; France 13,602; Austria 13,545.
Semimanufactures	11,626	4,974	70	Denmark 2,162; Switzerland 1,263; Sweden 989.
Lithium:				
Oxide and hydroxide	557	717	--	France 209; Italy 195; Belgium-Luxembourg 117.
Metal, all forms	16	12	--	Switzerland 6; France 3.
Magnesium:				
Oxide, hydroxide, peroxide	599	445	--	Denmark 125; Colombia 100.
Metal including alloys:				
Scrap	2,620	1,964	262	Italy 894; Netherlands 564.
Unwrought	179	200	--	Austria 116; Brazil 30; France 25.
Semimanufactures	409	482	--	Republic of South Africa 87; Sweden 64; France 50.
Manganese:				
Ore and concentrate	2,088	1,946	--	Netherlands 936; France 598; Denmark 175.
Oxides	3,527	5,171	--	Austria 117; France 107.
Metal including alloys, all forms	31	59	--	Italy 15.
Mercury 76-pound flasks	2,205	2,344	--	Netherlands 908; Switzerland 296; Egypt 174.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Molybdenum:				
Ore and concentrate	1,117	6,668	1,546	Belgium-Luxembourg 1,586; United Kingdom 810; Sweden 672.
Oxides and hydroxides[4]	5,976	2,748	NA	NA.
Metal including alloys, all forms	237	391	NA	NA.
Nickel:				
Matte, speiss, similar materials	7	1,332	--	Netherlands 500; Spain 464; Italy 305.
Oxides and hydroxides	290	147	--	Netherlands 45; Italy 33.
Metal including alloys:				
Scrap	7,150	8,380	363	Sweden 6,188; Austria 843.
Unwrought	5,175	11,337	456	France 4,352; Netherlands 3,757.
Semimanufactures	8,882	10,159	3,102	United Kingdom 1,448; France 659; Belgium-Luxembourg 533.
Platinum-group metals:				
Platinum:				
Ash and waste value	$57,752	$54,558	--	All to Belgium-Luxembourg.
Scrap and sweepings do	$658,668	$658,519	NA	Netherlands $503,574; Sweden $123,848.
Metal including alloys, unwrought and partly wrought troy ounces	r252,476	288,034	7,988	Switzerland 69,160; Netherlands 38,157; France 35,629; Japan 31,867.
Palladium metal including alloys, unwrought and partly wrought do	110,918	130,757	868	Netherlands 54,881; Switzerland 22,538; Japan 16,397.
Other metal including alloys, unwrought and partly wrought do	80,967	114,585	2,249	Japan 20,768; Republic of South Africa 13,923; Bulgaria 12,348.
Silicon metal	1,678	1,496	271	France 385; Netherlands 281; Belgium-Luxembourg 131.
Silver:				
Ash and waste value, thousands	$20,448	$3,213	--	France $1,510; Belgium-Luxembourg $1,378; Switzerland $312.
Scrap and sweepings do	$220	$1,071	--	Spain $445; Switzerland $394; Netherlands $158.
Metal including alloys, unwrought and partly wrought thousand troy ounces	39,192	33,508	322	Italy 4,070; Switzerland 3,976; Sweden 3,084.
Tin:				
Ore and concentrate	r500	100	NA	NA.
Metal including alloys:				
Scrap	88	52	--	Netherlands 36.
Unwrought	4,813	5,784	--	Netherlands 3,968; France 479.
Semimanufactures	741	781	--	Switzerland 94; Austria 93; Netherlands 38.
Titanium:				
Ore and concentrate	6,195	5,602	55	Netherlands 1,265; Bulgaria 1,046; Switzerland 973.
Oxides	48,073	48,018	7,775	Italy 5,105; Netherlands 3,290; France 2,650.
Metal including alloys, all forms	1,904	1,864	217	United Kingdom 481; Italy 324; France 269.
Tungsten:				
Ore and concentrate	87	174	--	Austria 111; Italy 36; Netherlands 18.
Metal including alloys, all forms	542	608	(3)	NA.
Uranium and thorium:				
Oxides including rare-earth oxides	1,212	1,923	1,421	Japan 208.
Metals including alloys, all forms kilograms	6,700	9,900	--	Italy 6,900; U.S.S.R. 2,400.
Vanadium metal including alloys, all forms	55	108	--	United Kingdom 85; Japan 18.
Zinc:				
Ore and concentrate	72,495	70,592	--	Netherlands 32,123; Belgium-Luxembourg 22,315; France 7,993.
Matte	4,514	5,609	--	Italy 2,025; Belgium-Luxembourg 1,418; France 1,309.
Oxides	12,033	15,166	NA	NA.
Metal including alloys:				
Scrap	7,254	8,824	--	Netherlands 6,344; Italy 1,263.
Blue powder	6,539	4,588	18	Netherlands 1,492; Romania 1,060; Spain 523.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Metal including alloys —Continued				
Unwrought	87,538	97,031	20,612	Netherlands 14,402; United Kingdom 8,234; Belgium-Luxembourg 6,206.
Semimanufactures	13,526	15,012	21	NA.
Zirconium:				
Ore and concentrate	6,885	8,205	--	France 2,170; Netherlands 1,334; United Kingdom 682.
Metal including alloys, all forms	97	127	23	France 52; Japan 20.
Other:				
Ores and concentrates:				
Of columbium, tantalum, vanadium	1,040	1,276	1,074	Belgium-Luxembourg 90; Japan 76.
Of base metals, n.e.s	5	2	--	Netherlands 1.
Ash and residue containing nonferrous metals	168,640	187,752	6,522	Belgium-Luxembourg 61,428; Netherlands 46,685; Sweden 20,680.
Oxides, hydroxides, peroxides	17,106	8,108	3	Italy 291; Brazil 288.
Metals:				
Metalloids:				
Arsenic and tellurium	2	10	--	France 2; Spain 1.
Selenium and phosphorus[5]	7,629	11,784	NA	NA.
Alkali, alkaline-earth, rare-earth metals	264	167	NA	NA.
Pyrophoric alloys	r62	39	--	Kuwait 6; United Kingdom 6; Hong Kong 5.
Base metals including alloys, all forms	615	960	175	France 344; Canada 136; Japan 106.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	1,619,101	426,761	34	Netherlands 373,412; Belgium-Luxembourg 37,358.
Artificial:				
Corundum	45,234	52,035	2,444	Italy 7,296; France 5,640; Sweden 4,592.
Silicon carbide	24,444	28,480	NA	NA.
Dust and powder of precious and semiprecious stones kilograms	385	414	69	Brazil 106; Greece 100; Austria 67.
Grinding and polishing wheels and stones	11,440	11,797	617	France 1,643; Netherlands 1,156; Belgium-Luxembourg 856.
Asbestos, crude	43,314	65,366	NA	NA.
Barite and witherite	38,178	38,720	--	Netherlands 9,623; France 7,118; Sweden 5,404.
Boron materials:				
Crude natural borates	11,966	11,589	--	Sweden 4,024; Italy 2,908; Norway 1,600.
Oxides, acid, borates, perborates	46,648	41,489	--	Switzerland 19,662.
Bromine	112	13	NA	NA.
Cement thousand tons	2,644	2,397	183	Netherlands 1,538; Nigeria 263; Belgium-Luxembourg 149.
Chalk	18,064	22,538	--	Denmark 7,135; Sweden 5,362; Finland 5,347.
Clays and clay products:				
Crude clays:				
Andalusite and kyanite	6,199	9,512	--	Italy 3,366; Austria 2,335; France 1,202.
Bentonite	25,014	26,250	--	France 12,182; Netherlands 5,220; Belgium-Luxembourg 3,530.
Ceramic clay	691,412	776,003	--	Italy 248,440; Netherlands 193,910; Belgium-Luxembourg 158,465.
Chamotte	36,473	45,618	--	Netherlands 20,319; Italy 5,739; Switzerland 5,465.
Dinas earth	39,401	60,770	--	France 24,989; Italy 9,123; Switzerland 7,652.
Fire clay	294,199	283,985	--	Netherlands 92,337; Italy 85,233; Belgium-Luxembourg 36,051.
Fuller's earth	1,086	3,157	--	Netherlands 1,801; France 768.
Kaolin	102,599	114,578	--	Italy 33,687; Austria 23,679; France 14,334.
Other	218,441	235,133	--	Netherlands 194,772; Italy 13,938; France 12,273.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products —Continued				
Products:				
Refractory including nonclay brick	622,672	639,466	16,996	Belgium-Luxembourg 104,802; France 90,242; Netherlands 44,014.
Nonrefractory	943,170	846,593	9,600	France 238,760; Belgium-Luxembourg 161,456; Netherlands 146,420.
Cryolite and chiolite	17	58	--	Italy 56.
Diamond:				
Crude, set or strung thousand carats	146	113	2	Belgium-Luxembourg 42; Switzerland 30; Hong Kong 7.
Industrial do	360	296	13	Ireland 122; Belgium-Luxembourg 43; Netherlands 35.
Diatomite and other infusorial earth	3,999	4,153	--	Netherlands 2,172; United Kingdom 524; Austria 414.
Feldspar, leucite, nepheline, nepheline syenite	18,759	17,802	--	France 5,928; Italy 3,290; Belgium-Luxembourg 2,014.
Fertilizer materials:				
Crude:				
Phosphatic	1,230	952	--	NA.
Potassic	32,279	49,296	--	Belgium-Luxembourg 25,810; United Kingdom 12,896; Netherlands 9,694.
Manufactured:				
Nitrogenous thousand tons	1,232	1,619	66	Belgium-Luxembourg 546; India 141; Brazil 140.
Phosphatic do	46	54	--	France 26; Austria 14.
Potassic do	2,378	2,433	31	Belgium-Luxembourg 709; India 214; Brazil 166; Ireland 166.
Other including mixed do	962	892	(3)	Belgium-Luxembourg 134; France 119; Austria 111.
Ammonia, anhydrous do	221	242	--	Denmark 111; France 57; United Kingdom 34.
Fluorspar	14,789	16,609	--	Austria 5,926; Netherlands 3,472; Czechoslovakia 1,358.
Graphite, natural	7,927	6,860	854	Italy 2,097; France 807; Spain 346.
Gypsum and plasters	355,983	356,918	--	Netherlands 210,794; Belgium-Luxembourg 43,946; Switzerland 38,749.
Iodine	31	45	--	Italy 14; France 9; Netherlands 5.
Lime	580,035	573,377	--	Netherlands 457,695; France 58,956.
Magnesite	21,693	20,445	281	France 5,443; Belgium-Luxembourg 3,158; Netherlands 2,570.
Mica:				
Crude including splittings and waste	777	642	--	Austria 150; Yugoslavia 139.
Worked including agglomerated splittings	427	332	--	United Kingdom 120; Yugoslavia 21; Australia 17.
Pigments, mineral:				
Natural, crude	84	22	NA	NA.
Iron oxides, processed	158,898	170,421	23,107	France 22,098; United Kingdom 14,776; Italy 13,029.
Precious and semiprecious stones except diamond:				
Natural kilograms	166,716	169,038	7,059	Hong Kong 10,218; Japan 9,691; Switzerland 8,367.
Synthetic do	19,728	26,380	3,147	Japan 13,176; Netherlands 3,896; Italy 3,295.
Pyrite (gross weight)	1,361	1,238	NA	NA.
Salt thousand tons	1,985	2,499	(3)	Belgium-Luxembourg 1,419; Sweden 254; Netherlands 206.
Sodium and potassium compounds, n.e.s.:				
Caustic soda do	1,176	1,379	40	Netherlands 200; Sweden 50; Canada 47.
Caustic potash do	15	14	NA	NA.
Soda ash	87,172	218,582	--	Belgium-Luxembourg 89,042; Saudi Arabia 22,926.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	3,286	5,230	--	Italy 1,744; Austria 1,278.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dimension stone —Continued				
Crude and partly worked — Continued				
Slate	11,170	12,556	--	Denmark 4,077; Belgium-Luxembourg 4,075; Netherlands 3,561.
Other	405,232	628,720	--	Netherlands 530,886; Switzerland 78,041; Austria 11,799.
Worked:				
Slate	1,616	1,139	--	Netherlands 636; Belgium-Luxembourg 165; France 112.
Paving and flagstone	24,284	14,917	--	Denmark 6,157; Belgium-Luxembourg 3,297; Netherlands 2,570.
Other	22,310	21,881	56	Belgium-Luxembourg 5,770; Austria 5,596; Switzerland 3,258.
Dolomite, chiefly refractory-grade	230,987	279,055	265	France 134,241; Netherlands 106,889.
Gravel and crushed rock thousand tons	9,646	9,264	--	Netherlands 7,198; Switzerland 844; Belgium-Luxembourg 716.
Limestone except dimension	66,562	80,157	--	Netherlands 58,662; Belgium-Luxembourg 165.
Quartz and quartzite	161,466	121,887	390	Belgium-Luxembourg 57,400; Netherlands 13,323; Austria 13,090.
Sand excluding metal-bearing thousand tons	8,350	8,093	--	Netherlands 6,688; Belgium-Luxembourg 877.
Sulfates, natural: Magnesium sulfate (kieserite)	536,386	512,916	18,922	Singapore 103,653; Norway 85,462; France 66,752.
Sulfur:				
Elemental:				
Other than colloidal	304,693	356,669	--	Netherlands 94,012; Denmark 74,575; Switzerland 51,181.
Colloidal	1,568	1,238	79	Italy 648; Belgium-Luxembourg 69; Yugoslavia 56.
Sulfur dioxide	11,871	8,744	--	Belgium-Luxembourg 4,397; Austria 1,831.
Sulfuric acid, oleum	625,406	802,738	--	Netherlands 213,811; Belgium-Luxembourg 112,676; Spain 84,298.
Talc, steatite, soapstone, pyrophyllite	7,949	5,607	--	Yugoslavia 1,644; Belgium-Luxembourg 616; Denmark 362.
Other:				
Crude:				
Pottery, broken	31,184	38,504	--	Netherlands 15,667; Belgium-Luxembourg 6,604: Switzerland 6,337.
Vermiculite, perlite, chlorite	2,767	4,403	--	Belgium-Luxembourg 3,046; Netherlands 500.
Unspecified thousand tons	1,657	1,289	--	Netherlands 1,188; Belgium-Luxembourg 26.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture do	2,993	2,658	--	Netherlands 2,533.
Other do	715	702	--	Netherlands 564; France 90.
Oxides and hydroxides of strontium and barium	2,547	3,633	1,323	France 793; Belgium-Luxembourg 407; Italy 337.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,941	6,552	--	Netherlands 4,323; Austria 1,327.
Carbon black	94,688	107,982	594	France 23,572; Austria 14,040; Belgium-Luxembourg 11,646.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	18,656	15,225	--	France 6,763; Belgium-Luxembourg 3,375; Italy 1,967.
Briquets of anthracite and bituminous coal do	382	391	--	France 159; Belgium-Luxembourg 133; Austria 38.
Lignite and lignite briquets do	509	718	--	France 207; Austria 178; Netherlands 167.

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke and semicoke thousand tons	9,124	10,958	--	Belgium-Luxembourg 3,214; France 2,041; Romania 1,118.
Gas:				
Natural million cubic feet	239,511	217,289	NA	NA.
Manufactured do	--	39	--	All to Switzerland.
Hydrogen, helium, rare gases	23,030	21,974	--	Italy 8,158; France 3,838; Austria 2,882.
Peat including peat briquets and litter	494,921	497,431	374	Netherlands 320,309; France 60,586; Switzerland 50,857.
Petroleum and refinery products:				
Crude thousand 42-gallon barrels	224	318	--	NA.
Refinery products:				
Gasoline:				
Aviation[6] do	21	35	--	United Kingdom 12.
Motor do	r5,889	6,250	9	Austria 2,229; Switzerland 1,937; Netherlands 778.
Kerosine do	r29	168	--	Netherlands 135; Austria 18.
Jet fuel[7] do	9,958	10,022	--	Sweden 488; Switzerland 368.
Distillate fuel oil[8] do	r3,324	3,144	--	Switzerland 627; Austria 540.
Residual fuel oil[9] do	r20,771	19,391	167	Austria 2,853; United Kingdom 1,822; France 1,484.
Lubricants do	r222	255	1	Denmark 128; Poland 28; Netherlands 16; Switzerland 11.
Other:				
Mineral jelly and wax do	r1,102	1,103	30	Italy 127; Netherlands 101; Austria 70; Belgium-Luxembourg 67.
Nonlubricating oils do	7,671	8,333	9	France 3,669; Netherlands 1,650; Belgium-Luxembourg 1,325.
Liquefied petroleum gas do	r3,668	4,303	--	Netherlands 1,206; Belgium-Luxembourg 718; United Kingdom 584.
Petroleum coke do	2,134	2,140	--	Netherlands 667; France 460; Switzerland 260.
Bitumen and other residues do	1,963	2,126	--	Austria 799; Denmark 410; Switzerland 319.
Bituminous mixtures do	380	457	--	Netherlands 340.
Unspecified do	r896	796	(3)	Netherlands 191; Belgium-Luxembourg 111; Switzerland 104.

rRevised. NA Not available.
[1]This table does not include exports to the German Democratic Republic.
[2]May include a small quantity of tin.
[3]Less than 1/2 unit.
[4]May include a small quantity of tungsten.
[5]Includes elemental sodium and potassium.
[6]Includes 15,183 barrels of bunker in 1978 and 16,296 barrels in 1979.
[7]Includes 8,831,216 barrels of bunker in 1978 and 8,744,192 barrels in 1979.
[8]Includes 1,840,695 barrels of bunker in 1978 and 1,434,931 barrels in 1979.
[9]Includes 26,627 barrels of bunker in 1978 and 40,786 barrels in 1979.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite thousand tons	3,614	3,694	--	Australia 1,722; Guinea 1,222; Sierra Leone 328.
Alumina	486,069	458,120	4,140	Australia 229,138; Italy 131,876; Suriname 66,892.
Aluminum hydroxide	2,080	1,712	1,087	France 355; United Kingdom 128.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Aluminum —Continued				
Metal including alloys:				
Scrap	137,345	157,124	28,403	Netherlands 47,538; France 13,738; Austria 12,757.
Unwrought	410,858	487,241	2,133	Norway 189,958; United Kingdom 83,680; Netherlands 56,703.
Semimanufactures	204,892	258,180	5,719	France 74,190; Netherlands 41,471; Belgium-Luxembourg 40,957.
Antimony:				
Ore and concentrate	3,040	3,126	--	Thailand 1,063; Bolivia 316; China, mainland 306.
Oxides and hydroxides	3,406	3,896	26	France 1,540; Belgium-Luxembourg 1,393.
Metal including alloys, all forms	748	567	--	Belgium-Luxembourg 208; China, mainland 161.
Arsenic trioxide, pentoxide acids	r647	825	NA	Belgium-Luxembourg 376; France 119; Sweden 102.
Beryllium metal including alloys, all forms kilograms	815	1,233	1,005	NA.
Bismuth metal including alloys, all forms	112	211	--	United Kingdom 94; Bulgaria 15.
Cadmium:				
Oxide and hydroxide	428	539	--	Belgium-Luxembourg 372; United Kingdom 157.
Metal including alloys, all forms	994	1,126	18	Belgium-Luxembourg 256; Japan 199; France 121.
Chromium:				
Chromite	371,738	546,786	--	Republic of South Africa 263,890; Albania 182,420; U.S.S.R. 20,998.
Oxides and hydroxides	1,453	1,407	166	U.S.S.R. 806; United Kingdom 166; Netherlands 94.
Metal including alloys, all forms	698	883	26	Belgium-Luxembourg 292; Japan 214; France 197.
Cobalt:				
Oxides and hydroxides	603	483	74	Belgium-Luxembourg 164; Japan 84; United Kingdom 56.
Metal including alloys, all forms	2,059	1,848	103	Belgium-Luxembourg 520; Zaire 464; France 125.
Columbium and tantalum metals including alloys, all forms:				
Columbium kilograms	10,743	22,078	18,557	Belgium-Luxembourg 3,000.
Tantalum do	251,247	252,425	186,539	United Kingdom 18,183; Japan 12,688.
Copper:				
Ore and concentrate	531,355	483,740	14,764	Papua-New Guinea 185,036; Republic of South Africa 72,001; Norway 64,047.
Matte	7,561	12,249	2,814	Canada 2,727; Yugoslavia 1,530; Australia 1,508.
Oxides and hydroxides	165	216	--	Italy 183.
Sulfate	8,575	12,477	--	France 6,245; Belgium-Luxembourg 2,870; U.S.S.R. 1,909.
Metal including alloys:				
Scrap	137,562	168,822	9,801	France 42,581; United Kingdom 28,764; Netherlands 27,579.
Unwrought:				
Smelter	109,225	62,785	80	Chile 29,072; Republic of South Africa 23,353; Norway 5,696.
Refined:				
Alloyed	46,399	53,358	252	United Kingdom 13,924; Romania 5,313; Switzerland 3,824; Hungary 3,680.
Unalloyed	428,794	449,995	10,860	Chile 136,634; Belgium-Luxembourg 71,150; Poland 68,731.
Master alloys	1,551	1,752	(2)	United Kingdom 905; Belgium-Luxembourg 637.
Semimanufactures	163,940	194,689	6,791	Belgium-Luxembourg 68,856; France 43,672; Italy 16,860.
Gallium metal including alloys, all forms kilograms	1,700	3,500	800	France 800; United Kingdom 800.
Gold:				
Ash and waste value, thousands	$2,408	$6,099	$1,948	Switzerland $1,896; Israel $635; Denmark $582.
Scrap and sweepings do	$3,106	$9,765	$46	Sweden $2,505; Switzerland $1,462; Israel $1,421.
Metal including alloys:				
Unwrought thousand troy ounces	3,600	3,377	438	Switzerland 1,799; U.S.S.R. 431.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Gold —Continued				
Metal including alloys —Continued				
Partly wrought thousand troy ounces	61	68	11	Republic of South Africa 19; Switzerland 13; Netherlands 10.
Hafnium metal including alloys, all forms kilograms	r200	100	NA	NA.
Iron and steel:				
Ore and concentrate thousand tons	42,133	51,703	--	Brazil 11,985; Liberia 7,591; Sweden 6,831; Canada 6,802.
Roasted pyrite do	533	626	--	Spain 409; Belgium-Luxembourg 152.
Metal:				
Scrap do	1,548	1,608	50	Netherlands 616; Belgium-Luxembourg 225; France 190.
Pig iron, including cast iron do	293	229	--	Brazil 67; Canada 57; Norway 33; Finland 16.
Sponge iron, powder, shot do	45	69	2	Venezuela 20; France 18; Sweden 16.
Spiegeleisen	37	17	--	NA.
Ferroalloys:				
Ferrochrome thousand tons	194	230	1	Republic of South Africa 126; Sweden 44; Turkey 15.
Ferromanganese do	160	152	3	Norway 56; France 47; Belgium-Luxembourg 14.
Ferronickel do	61	71	(2)	Greece 36; New Caledonia 31.
Ferrosilicon do	159	187	--	Norway 87; France 42; Spain 27.
Ferrosilicochrome do	6	11	1	Republic of South Africa 5; Sweden 4.
Ferrosilico-manganese do	101	116	--	Norway 54; Spain 18; Republic of South Africa 17.
Other do	17	18	4	France 5; Belgium-Luxembourg 3; United Kingdom 2.
Steel, primary forms do	2,571	2,518	--	Belgium-Luxembourg 703; Netherlands 481; Austria 271.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	4,020	3,963	1	Italy 625; France 535; Spain 304.
Universals, plates, sheets do	3,684	4,152	5	France 690; Austria 334; Netherlands 258.
Hoop and strip do	623	715	2	Belgium-Luxembourg 321; France 185; Netherlands 75.
Rails and accessories do	34	42	--	Netherlands 16; Canada 12; Sweden 4.
Wire do	236	256	(2)	Belgium-Luxembourg 99; France 50; Austria 17.
Tubes, pipes, fittings do	811	908	2	France 208; Italy 168; Netherlands 126.
Castings and forgings, rough do	36	43	(2)	France 8; Poland 6; Netherlands 5.
Lead:				
Ore and concentrate	170,055	191,179	--	Canada 47,232; Sweden 46,668; Morocco 24,260.
Oxides	6,455	6,111	133	France 2,086; Belgium-Luxembourg 1,682; Mexico 570.
Metal including alloys:				
Scrap	45,621	62,566	4,904	Netherlands 19,957; Canada 12,580; United Kingdom 10,538.
Unwrought	131,102	129,034	88	United Kingdom 41,098; Sweden 21,459; Belgium-Luxembourg 19,015.
Semimanufactures	2,822	4,054	--	Belgium-Luxembourg 2,245; Yugoslavia 767; France 739.
Lithium:				
Oxide and hydroxide	469	464	297	Netherlands 96.
Metal including alloys, all forms	17	9	8	NA.
Magnesium:				
Oxide, hydroxide, peroxide	r3,246	459	--	France 343; Italy 38.
Metal including alloys:				
Scrap	825	1,032	--	Netherlands 304; Denmark 163; Italy 108.
Unwrought	29,244	32,340	7,303	Norway 15,157; Italy 4,584; France 2,290.
Semimanufactures	359	500	189	Norway 142; Austria 122.
Manganese:				
Ore and concentrate thousand tons	673	717	--	Republic of South Africa 432; Australia 124; Brazil 76.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Manganese —Continued				
Oxides	2,625	5,462	--	Belgium-Luxembourg 3,162; Greece 905; Ireland 880.
Metal including alloys, all forms	5,438	5,848	991	Republic of South Africa 3,084; Netherlands 436; France 402.
Mercury 76-pound flasks	12,592	13,373	--	Algeria 3,568; Italy 2,466; Spain 1,682.
Molybdenum:				
Ore and concentrate	19,203	22,065	12,110	Canada 2,214; Netherlands 1,882; Chile 1,559.
Oxides and hydroxides	456	515	91	Netherlands 252; United Kingdom 54; Australia 40.
Metal including alloys, all forms	638	797	172	Austria 411.
Nickel:				
Ore and concentrate	10	34	--	U.S.S.R. 25.
Matte, speiss, similar materials	16,464	15,746	69	Australia 8,297; Canada 4,910.
Oxides and hydroxides	595	612	42	Canada 319; Netherlands 93; France 80.
Metal including alloys:				
Scrap	4,002	6,505	1,332	France 2,283; Netherlands 869; United Kingdom 594.
Unwrought	38,880	47,708	6,714	U.S.S.R. 8,330; Republic of South Africa 7,066; Norway 6,426.
Semimanufactures	5,280	6,325	1,295	France 2,321; United Kingdom 1,610.
Platinum-group metals:				
Platinum:				
Ash and waste value, thousands	$2,951	$2,580	$448	Italy $1,220; Netherlands $378; Switzerland $168.
Scrap and sweepings do	$19,060	$30,034	$2,624	Netherlands $5,848; Hungary $5,154; Belgium-Luxembourg $2,206.
Metal including alloys, unwrought and partly wrought thousand troy ounces	r301	510	84	United Kingdom 151; Switzerland 136; U.S.S.R. 51.
Palladium metal including alloys, unwrought and partly wrought do	431	382	50	U.S.S.R. 163; United Kingdom 80; Belgium-Luxembourg 35.
Other including alloys, unwrought and partly wrought do	128	114	53	United Kingdom 34; Republic of South Africa 15; U.S.S.R. 8.
Rare-earth metals:				
Oxides and other compounds	977	1,196	356	France 369; United Kingdom 240; Austria 187.
Metals, all forms	110	107	NA	NA.
Silicon metal including alloys, all forms	49,570	59,236	NA	France 19,766; Norway 11,042; Switzerland 5,425.
Silver:				
Ash and waste value, thousands	$20,448	$20,752	$10,991	Sweden $2,106; Switzerland $1,942; Norway $1,772.
Scrap and sweepings do	$6,424	$20,602	$2,180	United Kingdom $9,385; Netherlands $2,285; Hong Kong $1,976.
Metal including alloys, unwrought and partly wrought thousand troy ounces	43,904	42,489	3,326	Switzerland 9,413; United Kingdom 5,041; Sweden 4,372; Poland 3,818.
Tin:				
Ore and concentrate	7,989	7,158	--	United Kingdom 3,192; Bolivia 1,867; Republic of South Africa 1,703.
Oxides	20	30	--	France 15; Japan 10.
Metal including alloys:				
Scrap	624	340	--	Netherlands 127; Yugoslavia 79; Switzerland 59.
Unwrought	15,481	17,098	--	Indonesia 5,260; Thailand 4,746, Malaysia 2,718.
Semimanufactures	1,572	1,684	--	Netherlands 1,580.
Titanium:				
Ore and concentrate	519,562	574,005	1,880	Norway 378,508; Canada 116,629; Australia 45,490.
Oxides	17,586	21,916	454	Belgium-Luxembourg 13,044; France 2,554; United Kingdom 1,939.
Metal including alloys, all forms	3,871	3,836	602	Japan 1,991; U.S.S.R. 608; United Kingdom 208.
Tungsten:				
Ore and concentrate	3,422	4,097	72	China, mainland 1,726; Australia 526; Canada 244.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tungsten —Continued				
Oxides and hydroxides	428	294	--	Australia 285.
Metal including alloys, all forms	1,149	831	76	Austria 348; United Kingdom 77; Netherlands 58.
Uranium and thorium:				
Oxides	229	416	--	U.S.S.R. 382; France 24.
Metals including alloys, all forms	16	2	--	Mainly from France.
Vanadium:				
Oxides	1,850	710	--	NA.
Metal including alloys, all forms	27	42	42	
Zinc:				
Ore and concentrate	498,930	502,951	--	Canada 193,567; Sweden 70,139; Greenland 58,401.
Matte	5,783	4,231	--	Netherlands 1,539; Czechoslovakia 764; Belgium-Luxembourg 536.
Oxide and peroxide	6,673	6,853	--	France 2,540; Netherlands 2,074; Italy 740.
Metal including alloys:				
Scrap	9,637	12,369	1,160	France 2,317; Netherlands 1,910; United Kingdom 1,794; Denmark 1,519.
Blue powder	11,676	12,705	--	Belgium-Luxembourg 9,844; France 1,210; Netherlands 924.
Unwrought	152,294	156,138	--	Belgium-Luxembourg 74,539; Netherlands 33,779; France 6,545.
Semimanufactures	23,227	24,014	--	France 2,505; Netherlands 2,085; Yugoslavia 1,197.
Zirconium:				
Ore and concentrate	36,817	50,185	1,882	Australia 33,022; Republic of South Africa 10,970.
Metal including alloys, all forms	348	218	117	France 74.
Other:				
Ores and concentrates:				
Of columbium, tantalum, vanadium	870	1,458	51	Brazil 996; Thailand 118; Canada 100.
Of base metals	2,836	5,319	--	Chile 3,330; Australia 1,903.
Ash and residue containing nonferrous metals	302,408	402,496	18,337	Canada 107,690; Belgium-Luxembourg 32,499; United Kingdom 29,250.
Oxides, hydroxides, peroxides	6,869	2,001	187	France 699; United Kingdom 398.
Metals:				
Metalloids:				
Arsenic and tellurium	56	54	--	Belgium-Luxembourg 12; U.S.S.R. 12; Sweden 9.
Selenium and phosphorus	30,234	28,873	NA	NA.
Alkali, alkaline-earth, rare-earth metals	322	443	--	France 287.
Pyrophoric alloys	r67	37	NA	NA.
Base metals including alloys, all forms	680	691	124	Sweden 246; United Kingdom 48.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	43,787	66,202	1,581	Greece 50,581; Italy 4,424.
Artificial:				
Corundum	33,587	40,011	969	Netherlands 16,639; Hungary 6,000; Austria 4,982.
Silicon carbide	61,884	66,711	238	Norway 10,571; Italy 4,917; Poland 2,864.
Dust and powder of precious and semi-precious stones kilograms	1,856	2,205	1,422	Ireland 531; Switzerland 123.
Grinding and polishing wheels and stones	7,210	7,100	198	Austria 3,302; Italy 1,195; France 881; Spain 807.
Asbestos, crude	345,817	386,383	657	Canada 305,300; Republic of South Africa 31,612.
Barite and witherite	196,465	197,658	--	France 94,071; China, mainland 43,281; Spain 35,593.
Boron materials:				
Crude natural borates	124,564	143,862	72,997	Turkey 65,187; Belgium-Luxembourg 4,343.
Oxide, acid, borates, perborates	76,929	90,114	17,506	Belgium-Luxembourg 38,751; France 14,119; Turkey 7,559.
Bromine	1,871	2,922	--	Israel 2,290; United Kingdom 3.
Cement thousand tons	1,193	1,288	3	France 470; Belgium-Luxembourg 463; Netherlands 186.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Chalk	89,658	104,237	--	France 88,211; Belgium-Luxembourg 14,133.
Clays and clay products:				
Crude clays:				
Andalusite and kyanite	57,258	65,312	40,445	Republic of South Africa 16,872.
Bentonite	45,879	66,841	45,104	Greece 11,982; Belgium-Luxembourg 4,817.
Ceramic clay	96,548	91,421	--	France 32,414; Netherlands 26,410; United Kingdom 18,334.
Chamotte	70,037	90,398	989	France 34,635; Czechoslovakia 32,751; United Kingdom 12,675.
Dinas earth	4,964	6,550	--	Belgium-Luxembourg 6,449.
Fire clay	123,230	134,053	11,485	France 43,932; Czechoslovakia 43,634; United Kingdom 13,861.
Fuller's earth	6,785	5,282	3,250	Spain 1,256.
Kaolin	716,891	800,113	108,354	United Kingdom 471,070; Czechoslovakia 125,725.
Other	168,149	161,764	27,892	Czechoslovakia 52,153; France 45,163.
Products:				
Refractory including nonclay brick thousand tons	204	249	2	Austria 30; Czechoslovakia 30; France 25.
Nonrefractory do	1,560	1,795	--	Italy 649; Netherlands 593; France 223.
Cryolite and chiolite	1,244	2,724	--	Mainly from Greenland.
Diamond:				
Crude:				
Not set or strung thousand carats	3	--		
Other do	678	520	3	Belgium-Luxembourg 260; Israel 112; India 46.
Industrial do	1,165	1,057	75	Belgium-Luxembourg 363; Republic of South Africa 331; United Kingdom 102.
Diatomite and other infusorial earth	39,100	40,190	8,162	Denmark 23,763; France 6,910.
Feldspar, leucite, nepheline, nepheline syenite	126,080	120,150	--	Norway 86,411; Italy 15,318.
Fertilizer materials:				
Crude:				
Nitrogenous	867	2,631	--	All from Chile.
Phosphatic thousand tons	2,441	2,584	1,483	Morocco 384; U.S.S.R. 195; Senegal 180.
Manufactured:				
Nitrogenous do	1,319	1,466	26	Belgium-Luxembourg 461; Netherlands 375; Austria 205.
Phosphatic do	785	740	--	Belgium-Luxembourg 581; Netherlands 53; Tunisia 36.
Potassic do	94	88	--	France 85.
Other including mixed do	840	1,037	67	Belgium-Luxembourg 274; Austria 215; France 113.
Ammonia, anhydrous do	107	196	--	France 105; Austria 56.
Fluorspar	240,385	248,690	--	Republic of South Africa 53,456; Spain 33,910; Morocco 16,840.
Graphite, natural	28,583	26,062	97	China, mainland 6,180; Austria 5,768; Norway 2,612.
Gypsum and plasters	374,263	572,093	46	France 313,989; Austria 206,986.
Iodine	791	871	--	Japan 510; Chile 341.
Lime	111,191	153,558	--	France 124,482; Denmark 13,934.
Magnesite	322,409	386,152	26,589	Greece 113,667; Austria 42,821; North Korea 41,145.
Mica:				
Crude including splittings and waste	9,729	8,631	276	India 2,667; Argentina 1,779; China, mainland 970.
Worked including agglomerated splittings	579	611	--	France 268; Belgium-Luxembourg 197.
Pigments, mineral:				
Natural, crude	2,083	2,174	--	Austria 1,897; France 164.
Iron oxides, processed	5,499	6,152	440	Netherlands 2,181; France 1,390; Belgium-Luxembourg 902.
Precious and semiprecious stones except diamond:				
Natural kilograms	1,479,756	1,635,635	221,556	Brazil 1,012,548; Republic of South Africa 105,007.
Synthetic do	22,220	25,587	6,766	Switzerland 12,712; Japan 3,848.
Pyrite (gross weight)	116,669	98,943	--	U.S.S.R. 89,227; Spain 8,029.
Salt	700,421	914,848	--	Netherlands 547,381; Italy 202,985; France 150,096.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s.:				
Caustic soda	200,812	167,119	--	Belgium-Luxembourg 36,673; Poland 22,920.
Caustic potash	2,868	3,253	--	Spain 966; Belgium-Luxembourg 697; France 449.
Soda ash	178,012	197,422	1,553	Poland 43,369; France 34,075; Switzerland 22,416.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	148,547	124,036	--	Austria 50,753; Italy 38,272.
Slate	22,988	33,756	--	France 14,196; United Kingdom 7,742; Portugal 5,283.
Other	287,620	367,446	--	Sweden 82,409; Denmark 56,137; Republic of South Africa 42,861.
Worked:				
Slate	16,340	17,779	--	Spain 11,466; France 1,604; Italy 1,439.
Paving and flagstone	157,442	212,321	--	Portugal 98,351; Italy 54,363.
Other	493,064	510,747	--	Italy 451,665.
Dolomite, chiefly refractory-grade	735,085	680,951	--	Belgium-Luxembourg 586,364.
Gravel and crushed rock thousand tons	12,962	12,261	(2)	France 7,030; Denmark 1,800; Austria 362.
Limestone except dimension do	1,505	1,501	--	Austria 815; Belgium-Luxembourg 255; Sweden 196.
Quartz and quartzite	77,561	121,860	672	Belgium-Luxembourg 48,126; Netherlands 23,886; Yugoslavia 13,046.
Sand excluding metal-bearing thousand tons	3,328	3,630	1	France 2,362; Netherlands 803; Poland 221.
Sulfur:				
Elemental:				
Other than colloidal	385,843	385,973	70,950	Poland 193,772; Canada 84,639.
Colloidal	572	732	--	France 703.
Sulfur dioxide	15,630	8,534	--	Sweden 7,482; Switzerland 1,019.
Sulfuric acid, oleum	82,942	43,918	--	France 14,763; Switzerland 13,260.
Talc, steatite, soapstone, pyrophyllite	127,524	125,688	249	Austria 52,342; France 25,126.
Other:				
Crude:				
Pottery, broken	64,087	95,169	--	France 28,877; Netherlands 14,452; Belgium-Luxembourg 12,824.
Vermiculite, perlite, chlorite	105,478	136,938	1,010	Greece 102,316; Republic of South Africa 18,084.
Unspecified	728,184	795,909	9,323	Austria 198,269; United Kingdom 165,465; France 159,535.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture thousand tons	1,674	1,943	--	France 1,029; Belgium-Luxembourg 647.
Other do	300	427	2	France 227; Belgium-Luxembourg 64; Italy 48.
Oxides and hydroxides of strontium and barium	732	791	--	France 398; Netherlands 284.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18,603	21,170	6,346	Trinidad and Tobago 13,468.
Carbon black	48,757	58,246	3,451	France 21,651; Netherlands 17,757.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	6,564	7,773	1,210	Poland 2,402; Republic of South Africa 1,052; United Kingdom 703.
Briquets of anthracite and bituminous coal	NA	56	NA	NA.
Lignite and lignite briquets thousand tons	1,474	1,606	--	Czechoslovakia 1,595.
Coke and semicoke do	925	1,132	328	France 286; Netherlands 151; Belgium-Luxembourg 94.
Gas, natural million cubic feet	1,451,067	1,645,762	NA	NA.
Hydrogen, helium, rare gases	18,260	27,071	422	Belgium-Luxembourg 14,516; Netherlands 11,229.
Peat and peat briquets	53,024	70,275	--	U.S.S.R. 53,905; Poland 10,346.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products:				
Crude thousand 42-gallon barrels	681,339	770,942	--	Libya 132,045; Saudi Arabia 131,499; Nigeria 107,766.
Refinery products:				
Gasoline:				
Aviation do	241	270	--	Netherlands 104; United Kingdom 93; Italy 65.
Motor do	r38,096	22,801	16	Netherlands 11,049; Belgium-Luxembourg 3,498; France 3,277.
Kerosine do	r670	933	7	United Kingdom 252; Netherlands 198; Italy 120.
Jet fuel do	13,824	14,523	--	Netherlands 10,881; Belgium-Luxembourg 1,959.
Distillate fuel oil do	r156,991	129,577	8	Netherlands 60,675; U.S.S.R. 16,960; Belgium-Luxembourg 11,747.
Residual fuel oil do	r40,202	31,338	3	Netherlands 9,895; France 5,188; U.S.S.R. 3,917.
Lubricants do	r928	1,198	57	France 360; Netherlands 351; United Kingdom 326.
Other:				
Nonlubricating oils do	r47,694	42,566	128	Netherlands 21,052; U.S.S.R. 6,241; Romania 3,804.
Mineral jelly and wax do	r1,092	1,439	9	Netherlands 201; France 143; Republic of South Africa 50.
Liquefied petroleum gas do	r3,551	4,915	(2)	Netherlands 1,131; France 1,045; Czechoslovakia 698.
Petroleum coke do	6,555	8,274	7,251	United Kingdom 316.
Bitumen and other residues do	1,774	1,677	--	France 848; Netherlands 750.
Bituminous mixtures do	194	144	3	Netherlands 94; France 12; Switzerland 12.
Unspecified do	15,985	19,773	363	U.S.S.R. 8,639; Libya 3,618; Italy 1,465.

rRevised. NA Not available.
[1]This table does not include imports from the German Democratic Republic.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—In 1980, the Government-owned VAW member of the Vereinigte Industrie-Unternehmungen AG (VIAG) concern, a holding company, commissioned the first half of its newly built aluminum smelter at Töging, Bavaria, replacing its old pre-1914 smelter at the same location. The second half is due for commissioning in 1982. The completion of the smelter is to raise capacity of the plant from 55,000 to 75,000 tons per year, with a line of 120 pots. The plant is expected to be 20% to 25% more energy efficient and to have improved pollution control. Hydropower is to be purchased as previously from VIAG's Innwerk. Construction costs are estimated at about $100 million.

VAW was planning the construction of a secondary aluminum smelter in West Berlin at a cost of $6 million. Smelted West Berlin scrap and some primary aluminum will also be extruded there at the rate of 15,000 tons per year.

It was reported that no plans existed to build new additional primary capacity in the FRG aluminum industry because of the high level of construction and other costs. The FRG index of electricity prices has risen to 172; labor costs have risen to 186; and oil prices to 442 (all 1972=100). In the meantime, VAW's list price for aluminum ingot has risen only 50% since 1970. The company was therefore considering building smelters abroad in countries with low-energy cost; it was negotiating the construction of a 220,000-ton-per-year smelter in Brazil, and also had under consideration projects for aluminum smelters in Australia and Canada. In 1980, the FRG's smelter output declined slightly. The country's total

primary capacity remained basically unchanged at 762,000 tons per year in 10 plants operated by 6 companies. Alumina capacity remained at approximately 1,730,000 tons per year in five alumina plants controlled by four companies. Some of the alumina and all of the bauxite used was imported.

Cadmium.—The FRG's Internal Affairs Minister announced plans to tighten the country's controls on production and use of cadmium for environmental reasons. The FRG has two of Europe's three largest producers of cadmium—Preussag AG and Metallgesellschaft AG—as well as some of Europe's largest consumers, among chemical companies such as BASF, Bayer, and Bärlocher.

Iron Ore.—In 1980, the FRG produced 1,948,000 tons of iron ore (iron content, 596,000 tons) in 10 mines operated by 4 domestic companies. The total was slightly up from that of the previous year, mainly because of the increased use of new modern equipment. A total of 803 people were employed in iron ore mines. Domestic production supplied less than 4% of the iron ore used by the iron and steel industry. The remainder of the supply, amounting to more than 50 million tons, was imported from various countries including Sweden, Norway, and France in Europe; Liberia and the Republic of South Africa in Africa; Brazil and Canada in the Americas; and Australia.

Iron and Steel.—In 1980, Thyssen Niederrhein AG Hütten-und Walzwerke, a member of the Thyssen Group, commissioned a new ministeelworks at Oberhausen in the Ruhr. This event marked the completion of the company's transition from an integrated steelmaker producing both flat-rolled and long products to an electric furnace operator mainly making rebars and wire rod. Concurrently, the company's last open-hearth furnace in Oberhausen (where a century earlier open-hearth steelmaking was introduced) was closed down.

The Krupp Group has consolidated all of its forging activities into one company. Forging activities of the Krupp Metall und Schmiedewerke in Essen and those of Friedrich Krupp Hüttenwerke AG in Bochum were united under the name of Friedrich Krupp Stahlschmiede. The new company had 3,500 employees and was expected to generate a turnover of $200 million.

Norddeutsche Ferrowerke, a subsidiary of Korf Industrie und Handel GmbH & Co. KG, and of Sydvaranger AS of Norway, was completing construction of its direct-reduction steel plant in Emden based on Norwegian natural gas. The $210 million plant, due for completion in 1981, has two Midrex-type furnaces with total capacity of 880,000 tons per year. Shipments of Norwegian and Swedish iron ore pellets (from Svappavaara) started in 1980 to fill the 280,000-ton ore storage space. The plant is said to be the first in the FRG to produce sponge iron for sale to other steel plants. The sponge iron is treated to protect it against oxidation by the company's special proprietary process.

Several other steel companies also had plans to modernize their plants. AG der Dillinger Hüttenwerke was planning to build a 3.15-million-ton-per-year sinter machine at its Killingen plant in the Saar for $35 million. Hoesch Hüttenwerke AG of Dortmund was planning to build a 2-million-ton-per-year oxygen steel mill and a continuous-casting machine at its Westfalenhütte plant for $25 million. Thyssen Edelstahlwerke AG was planning to build a 300,000-ton casting plant at its Krefeld works at a cost of $40 million. The plant is expected to be completed by the end of 1981. Thyssen Edelstahlwerke was planning construction of a new 110-ton arc furnace at its Witten works in the Ruhr with a capacity of about 480,000 tons per year, at a cost of $16 million. The furnace is mainly to replace an open-hearth steel plant at the same location.

In November, the Mannesmann Group voted to incorporate the Mannesmann AG Hüttenwerke (Steelworks) into Mannesmannröhren-Werke AG (Pipe Works), and thereby give up steel company status to avoid the special codetermination laws that apply to the coal and steel industries. In those industries, the labor representatives exert greater power in deciding tie votes than do union representatives on the supervisory board of nonsteel companies. However, a compromise was worked out by the Bonn Government postponing the Mannesmann merger until 1987.

The FRG Government, always a strong supporter of the free enterprise system, participated reluctantly in the European Communities' steel production quotas during 1980. By yearend, the FRG was considering countervailing duties if the Communities would not prohibit subsidies by other governments to their respective steel indus-

tries. A deadline to eliminate all such subsidies was set by the FRG Government for June 31, 1981.

In 1980, total raw steel production of the FRG declined somewhat to 43.8 million tons, although it was still the largest among West European countries. Pig iron production declined also to about 33.9 million tons. Top crude steel producers in 1979 (output in million tons) were the Thyssen Group (12.2), Hoesch-Estel Group (11.5), Krupp Group (5.2), Klöckner Group (5.1), Peine-Salzgitter Group (4.4), and Mannesmann Group (4.3).

More than 48 companies produced stainless and alloy steels in the FRG; the most important producers, representing about 60% of the national output, were, in decreasing order of output, the Edelstahlwerke Buderus AG at Wetzlar; Klöckner Werke AG in Osnabrück; Friedrich Krupp Hüttenwerke AG in Bochum; Stahlwerke Röchling Burbach GmbH (Arbed) of Völklingen in the Saar; Stahlwerke Südwestfalen AG in Siegen; and Thyssen Edelstahlwerke in Krefeld.

Lead, Zinc, and Copper.—Falling metal content in the remaining ore reserves and persistent low prices could make necessary the shutdown of the 100-year-old lead-zinc mine at Meggen, North Rhine Westphalia, according to the owner, Metallgesellschaft AG, but there were no immediate plans to do so. One-quarter of the 940 employees of the mine were already working in a new mining service enterprise for third parties.

A new fill process, adapted during the previous year, was used at the Bad Grund (Lower Saxony) lead-zinc-copper mine. Tailings are pumped back in water suspension, mixed with 3% cement, giving good stability and increased safety at reduced cost.

Only three metal mines in the FRG were left in 1980: Meggen (lead-zinc), operated by Metallgesellschaft's Sachtleben Bergbau GmbH; and Bad Grund (lead-zinc) and Rammelsberg (lead-zinc-copper), both located in Lower Saxony, and both operated by Preussag AG Metall. The FRG smelting and refining capacity remained approximately unchanged at 395,000 tons per year of lead, 435,000 tons per year of zinc, and 260,000 tons per year of copper. Domestic mines provided only about 1% of the copper and less than a quarter of the lead and zinc.

NONMETALS

Graphite.—Mining at the Kropfmühl graphite mine near Passau, west of the Austrian border, was extended by nearly a mile of new tunnels at the Erhard shaft. The mine was operated by Graphitwerk Kropfmühl AG.

Artificial graphite was produced in the FRG by the Sigri Group, the second largest producer after Union Carbide Corp. of the United States. Sigri is owned jointly by Hoechst AG of Frankfurt and Plania-Beteiligungs GmbH of Munich, the latter two-thirds owned by Rüttgerswerke AG. The group controlled five graphite producers operating seven plants located throughout Europe. The largest of them was Sigri Elektrographit GmbH, which had two plants, one at Meitingen near Augsburg and another at Griesheim near Frankfurt.

Limestone.—Burnt limestone production in the FRG was fairly constant, around 9 to 10 million tons during the last decade. The principal area of production was the State of North Rhine Westphalia, with about 60% of the total. About 35% of the burnt lime is used for iron and steel, 22% for building materials, 15% in the construction industry, and 10% in the chemical industry. Although a large number of companies produce burnt lime in the country, only two companies account for half of the production. The largest producer is the Rheinische Kalksteinwerke GmbH, part of the large Wulfrath Group, 75% owned by the Thyssen Group and 25% by Friedrich Krupp GmbH. Although plants are in various places, principal operations are located northeast of Düsseldorf, with total burnt lime capacity about 2.6 million tons per year. The second most significant producer is Rheinisch Westfälische Kalkwerke AG, with about 2 million tons of burnt lime capacity. Other significant producers are Fels-Werke Peine-Salzgitter GmbH (capacity of 500,000 tons of burnt lime) and Johann Schaefer Kalkwerke (capacity of around 300,000 tons of burnt lime).

Potash and Salt.—In 1980, a persistently high level of demand led to increased potash production. More than 29 million tons of raw ore was produced with a K_2O equivalent of 3.3 million tons; gross weight of product produced was 8.1 million tons and sales (expressed as K_2O) were 2.737 million tons. A substantial decrease in salt production from that of 1979 was probably owing to slack demand because of milder weather.

The FRG's potash output was controlled mainly by two companies. Kali und Salz AG controlled nine mines with approximately 90% of domestic production. Funds earmarked for investment in potash produc-

tion by the company in 1980 were $60 million, and employees numbered about 8,800 persons. Kali Chemie AG controlled one mine with about 10% of domestic production.

Sodium Carbonate.—The FRG sodium carbonate production in 1980 increased to about 1.4 million tons. The largest producer was a subsidiary of the Solvay Group with an operating capacity of about 1.3 million tons per year, including the Deutsche Solvay Werke plant at Rheinberg in the Ruhr, and the Kali Chemie plant in Heilbronn, north of Stuttgart. The second largest producer was the Chemische Fabrik Kalk GmbH, a subsidiary of Kali und Salz, operating a 280,000-ton-per-year plant located at Köln-Kalk.

MINERAL FUELS

In 1980, domestic coal, lignite, natural gas, and crude oil supplied about one-third of the FRG's energy consumption. Imported oil accounted for almost one-half of all primary energy used, amounting to 182 million tons of standard coal equivalent (SCE) or 47.8% of all energy used. Bituminous coal used was 77 million tons of SCE or 19.7%; natural gas used was 64.5 million tons of SCE or 16.5%; lignite was 38.5 million tons of SCE or 9.9%; nuclear energy was 14.0 million tons of SCE or 3.6%; waterpower and imported electricity was 7.5 million tons of SCE or 1.9%; and the remainder including fuelwood was 2.5 million tons of SCE or 0.6%.

Coal, Coke, and Lignite.—In 1980, the FRG's bituminous coal production increased for the second consecutive year, reaching almost 88 million tons; consumption closely equaled production.

Stocks of coal at yearend were about 30 million tons including reserves of coke, consisting of 9 million tons of producers' stocks, 10 million tons of consumers' stocks, and 10 million tons in the national coal reserves. This should be sufficient for supplying the country for about 120 days. At yearend, 186,800 persons were employed by the bituminous coal industry, an increase of 4,500 during 1980. The number of employees underground was 99,800.

The FRG's lignite production in 1980 was slightly under 130 million tons. Lignite briquette production decreased to under 4.5 million tons.

To diversify sources of supply, import restrictions on non-European Community coal were relaxed resulting in an increase of imports. There were also official discussions with Poland and mainland China. Private FRG banks were planning to grant Poland a $600 million loan, one-third of which was to go for developing new Polish coal mines, and this part of the loan was to be repaid by additional coal shipments on the order of 1 million tons per year starting in 1985. In 1979, Poland was the FRG's single largest coal supplier with shipments of about 2.4 million tons of coal and 70,000 tons of coke. In 1979, the FRG imports of U.S. coal increased also, from 585,000 tons (plus 325,000 tons of coke) in 1978 to 1,200,000 tons (plus 330,000 tons of coke).

The FRG coking coal has been subsidized since 1967 to offset the difference between FRG prices and world market prices. This difference, which was Deutsche mark (DM) 7 per ton in 1967, reached about DM55.80 per ton in the fourth quarter of 1979 when the world market price was DM115.20 per ton and the domestic price was DM171 per ton. The Federal Government and the Government of North Rhine Westphalia (NRW), together paid DM45 per ton of the 1979 fourth quarter subsidy, two-thirds by the Federal Government. Coal suppliers and coal users (such as steel mills) contributed DM5.40 per ton each. In the case of coal exports to the Common Market, coal users made no contribution, but the FRG received compensation from a European Economic Council fund. The Government subsidy for 1980 was set at DM53 per ton and for 1981 at DM45 per ton. In 1980, NRW contributions totaled over DM0.5 million.

In 1980, the FRG had 40 coal and 17 lignite mines, 21 coking plants, 5 briquetting plants, and 29 mine-mouth powerplants. The bituminous coal industry was controlled mainly by seven companies: Three in the Ruhr, two in the Aachen area, and one each in the Saarland and Lower Saxony. The largest coal industry group was the Ruhrkohle AG, controlling about three-quarters of the country's bituminous coal output.

In 1980, the FRG's lignite industry was dominated by the Rheinische Braunkohlenwerke AG, which accounted for nearly four-fifth's of the country's output; the remaining production came from two medium-sized and four smaller companies.

Nuclear Power.—Esso AG of Hamburg was planning to invest $100 million to develop a uranium ore mine in the vicinity of Wunsiedel, on the southeast slopes of the Fichtel Mountains, east of Bayreuth. There

were no data on grade of ore or reserves. About 35 people were engaged in exploration work on the site. When commissioned, the mine was to be the first commercial uranium mine in the FRG.

In 1980, the FRG operated 15 commercial nuclear powerplants, belonging mostly to local utilities, with a total nominal capacity of 8,767 megawatts. In 1980, the plants consumed nuclear fuel at the rate of 14 million tons of standard coal equivalent, slightly more than that of 1979. The plants generated 43.7 billion kilowatt-hours, which is 1.4 billion kilowatt-hours more than in 1979. Another 11 nuclear powerplants were under construction, with a total nominal capacity of over 13,000 megawatts. Experiments continued for storing radioactive waste materials at the Asse salt mine south of Hannover. In the meantime, test drilling continued at the Gorleben salt dome in Lower Saxony to prepare a waste storage facility there.

Petroleum and Natural Gas.—In 1980, crude oil and natural gas production decreased slightly to about 4.6 million tons, and 18.7 billion cubic meters, respectively. Crude oil imports decreased significantly to 97.9 million tons, while natural gas imports increased to 47 billion cubic meters. Refinery output also decreased significantly to 98.6 million tons. Crude capacity (throughput) of the FRG's refineries was 150.4 million tons per year. Refining capacity was owned by about 21 companies controlling 39 oil refineries. Five refineries were under construction. The FRG refineries continued to extend their conversion capacities during the year including catalytic crackers, hydrocrackers, and thermal cracking units.

In 1980, the FRG imported more natural gas than any country in the world, amounting to about one-fifth of all world exports. Two-thirds of consumption came from imports, mainly from the Netherlands and Norway. An internationally controversial subject was the FRG's plan to participate in building a natural gas pipeline from the Soviet Union to Europe, which would deliver to the FRG 10 billion cubic meters of natural gas per year or about one-sixth of the country's consumption.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted to U.S. dollars from Deutsche marks (DM) at the rate of DM1.8875=US$1.00 for 1980.

The Mineral Industry of Ghana

By George A. Morgan[1]

In 1980, the mineral industry in Ghana experienced continued stagnation in terms of production of several major commodities. The industry as a whole was adversely affected by many of the problems that affected other sectors in the economy, such as the loss of experienced personnel, insufficient food, and persistent shortages of parts and equipment. A number of commodities, including cacao and diamond, were selling at less than the cost of production. The country also suffered from work stoppages in critical industries. The Government raised the minimum wage by 300%, which affected employees in the more than 100 semiautonomous State bodies, including the State Gold Mining Corp (SGMC). The cost of public sector wages made up 40% of total Government expenditures. A new directive specified the dismissal of public corporation employees who engaged in work stoppages. Thus, striking officers and officials of the Black Star Line, the Government-owned transportation company, were replaced with foreign specialists.

Public corporations were to show a profit prior to consideration of worker requests. Inflation, which had declined from 117% in 1977 to 40% by early 1980, rose to 50.1% by yearend 1980. High expenditures resulted in 83% of the Central Bank's total net assets and 62% of commercial bank assets being borrowed by the Government, leaving little for the private sector. The extreme shortage of foreign exchange, of which one-third was required for the purchase of imported oil, also affected the private sector to the extent that it was functioning at only 25% to 30% of capacity. The Ashanti Goldfields Corp., the country's leading gold producer with about 67% of total output, operated at only two-thirds of capacity during a period of record gold prices. Problems within both the public and private sectors were exacerbated by price controls and a deteriorating transportation system. Price controls had the effect of limiting return to the producers, who subseqently reduced output. Large quantities of imported fertilizer purchased with scarce foreign exchange remained at ports because of the lack of transport. Smuggling of many commodities increased, particularly diamond and gold.[2]

The Government's efforts to alleviate the failing economy were directed at a 2-year period of rehabilitation of basic industries and infrastructure, and by conserving and increasing foreign exchange through the exploitation of local resources. About $900 million in international aid was estimated to be required for the program.[3] The World Bank granted a $33 million loan for overhauling the 1,300-kilometer-long railroad system. The Federal Republic of Germany granted loans totaling $40 million for developing the Volta Lake transportation system. A cooperative agreement was also concluded with Romania for the reopening of old mines and exploration of potential ore bodies.

An Investment Code bill incorporating all existing legislation, including the 1973 Capital Investments Decree and the 1975 Investment Policy Decree, has been proposed.

PRODUCTION AND TRADE

Output of mineral commodities remained relatively unchanged, excluding production of aluminum metal from imported alumina which increased to a record high. Shortages of foreign exchange, spare parts, and equipment continued to stagnate the industry. In the case of diamond and manganese ore, declining ore grade and decreased reserves also were limiting factors in maintaining production capacity. Evaluation of manganese carbonate reserves continued, with the aim of supplanting the country's nearly exhausted manganese oxide reserves.

A proposal was made to expand gold output. Attention was drawn to Ghana's gold industry because of the metal's high price, making it a significant source of foreign exchange revenue.

Oil production was estimated to have expanded in 1980 despite mechanical problems at the Saltpond Oilfield. Although output was insignificant, additional finds will help to offset the large fuel import bill currently being experienced. The major portion of oil imports was from Nigeria.

A trade agreement with Romania provided for the exchange of cacao and timber in return for mining equipment and exploration assistance. The Government began the approval of import licenses on the basis of need, rather than on the basis of available foreign exchange.

Table 1.—Ghana: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979	1980[p]
Aluminum:					
Bauxite, gross weight ____ metric tons	271,563	244,217	328,087	213,679	225,050
Metal, smelter, primary ____ do	151,391	153,468	111,364	168,727	187,667
Cement, hydraulic ____ thousand metric tons	[e]650	610	500	400	240
Diamond:					
Gem ____ thousand carats	[e]228	230	[e]142	[e]125	[e]126
Industrial[e] ____ do	2,055	1,717	1,281	1,128	1,132
Total ____ do	2,283	1,947	1,423	1,253	1,258
Gold ____ thousand troy ounces	532	481	402	362	353
Iron and steel: Crude steel ____ metric tons	15,000	15,000	10,000	5,000	[e]5,000
Manganese ore and concentrate, gross weight do	311,872	291,585	315,577	272,160	252,451
Petroleum:					
Crude ____ thousand 42-gallon barrels	--	--	285	556	650
Refinery products:					
Gasoline ____ do	1,890	1,928	2,231	[e]2,200	
Jet fuel ____ do	385	392	309	[e]300	
Kerosine ____ do	732	747	1,046	[e]1,000	
Distillate fuel oil ____ do	2,482	2,531	2,455	[e]2,400	NA
Residual fuel oil ____ do	2,440	2,589	2,080	[e]2,000	
Other ____ do	98	92	137	[e]130	
Refinery fuel and losses ____ do	466	384	393	[e]390	
Total ____ do	8,493	8,663	8,651	[e]8,420	[e]8,500
Salt[e] ____ metric tons	52,000	50,000	50,000	50,000	50,000
Silver, mine output, metal content thousand troy ounces	NA	NA	19	20	[e]20

[e]Estimated. [p]Preliminary. NA Not available.
[1]Table includes data available through Sept. 3, 1981.
[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

COMMODITY REVIEW

METALS

Aluminum.—A bauxite development company was to be established to exploit deposits in the Kibi area.[4] Nigeria and Ghana held preliminary negotiations regarding a possible joint venture to mine the deposit which had 182 million tons of ore. Inadequately operating rail transport from the country's only operating bauxite mine at Awaso to the Port of Takoradi continued to hinder production. The mine was operating at less than one-half of the 500,000-ton-per-year rated capacity.

The Government was seeking to renegotiate the terms of the contract under which the Volta Aluminum Co. (VALCO) originally was granted electric power for its 198,000-ton-per-year aluminum smelter at Tema. The electricity rates were part of a long-term contract between Kaiser Aluminum & Chemical Corp., which built both the smelter and Volta River hydroelectric plant, and the Ghanaian Government.

Columbite-Tantalite.—Ashanti Goldfields Corp. commenced prospecting for columbite-tantalite mineralization near Winneba. The company had originally spent 3 years prospecting in the area, but suspended its search in 1962.

Gold.—The high price of gold in 1980 resulted in considerable attention being drawn to deficiencies in the gold mining industry of Ghana. The mines of the Government-owned SGMC were unable to maximize revenue from the production and sale of gold. Black-market operations have reportedly increased because of the disarray of the industry. Numerous reasons for the decline in output from a level of about 700,000 troy ounces per year in 1973 to the current level of about 400,000 troy ounces per year were reported by a committee appointed to study the problems of the industry. The committee noted that there had been no new gold mining ventures since 1938, with only four mines currently operational. Exploration, both at existing mines and at new sites, has been inadequate.

The generally negative growth in all economic sectors, coupled with scarcities of essential commodities and equipment, were compounded by the Government's lack of a consistent mineral policy. In the past 5 years, the gold industry has been subject to numerous taxes which undermined profitability. Such taxes included a 6.5% royalty on the gross value of minerals, a mineral duty of 5% to 10%, an import duty of 35%, and a foreign exchange tax of 33% to 75%, as well as other taxes.[5]

Tarkwa Goldfields Ltd., 100% controlled by SGMC, had a design capacity of 740,000 tons per year of ore yielding approximately 170,000 troy ounces of gold. However, actual output in 1980 was only about 250,000 tons yielding 41,000 troy ounces. Ashanti Goldfields Corp., 55% controlled by SGMC and 45% by Lonrho Ltd., was the country's principal producer accounting for 67% of total production in 1980. Output by the company was up 5% or 12,000 troy ounces over that of 1979. The Konongo Mine was forced to shut down because of depletion of minable ore, despite continued Government attempts to forestall closure to avoid exacerbating the unemployment situation.

Reserves of exploitable gold were reported at about 1.3 billion troy ounces. The technical committee, assisted by the United Nations Development Program (UNDP), recommended the rehabilitation and expansion of the existing mines and the establishment of several others. A Gold Promotion Council has been set up by the Government to coordinate Government activities for developing the gold industry. Gold sales made up about 10% of export earnings, and if high gold prices continue, may supplant aluminum as the second highest exchange earner after cacao.

NONMETALS

Diamond.—Despite a slight increase in output of diamond in 1980, prospects appeared poor for continued viability of the industry which accounted for about 4% of world output in 1979. Current deposits, which were declining in grade, were estimated to provide only about 2 more years of productive life. The major portion of output was from Ghana Consolidated Diamonds Ltd. (GCD), which employed about 2,000 people. GCD has suffered a severe loss of experienced managerial personnel, and was also losing trained artisans, mainly to higher paying positions outside the country. In addition, old equipment, lack of spare parts, and high local costs may result in a loss of about $7 million for the year ending June 30, 1981.

GCD was 55% controlled by the Government of Ghana and 45% by Consolidated African Selection Trust Ltd., which manages the company. Actual diamond output was sold through the Diamond Marketing Co., usually at three auctions per year. All output was sold overseas, with 12.5% of exports reserved at the option of mainland China under a bilateral commercial agreement. The value of exports in 1980 was estimated at about $11.8 million. The Diamond Industry Commission was established in March 1980 to conduct hearings both on the industry itself and GCD in particular. GCD was seeking about $40 million to purchase draglines and other equipment to expand its plant at Akwatia.[6] The United Nations continued assistance to diamond

prospecting on the Birim River. The first phase of the program was to be completed in 1982.

Limestone.—Work commenced on a $12.4 million limestone project at Buipe in the northern region. Hydrated lime was to be produced both for local consumption and for export, with full production planned for 1982. Output was to be at the rate of 40,000 tons of lime per year, and 200 Ghanaians were to be employed. The project was a joint venture of Ceramica Cordiere S.A. of Italy, the Bank of Housing and Construction, and the Northern Regional Housing Corp. A $15 million loan was advanced by the Italian Government for machinery and equipment for the undertaking.

MINERAL FUELS

Petroleum.—Output from Ghana's only producing oilfield at Saltpond by Agri-Petco Co. averaged 1,522 barrels per day in 1979 and nearly 1,800 barrels per day in 1980. No gas production was reported.

Phillips Petroleum Co. reported the discovery of oil at Half Hassini. Further drilling was planned to complete an evaluation of the find. The company has invested $60 million thus far in its operations in Ghana and expected to spend another $10 million in its search for oil and gas. Another company was awarded an onshore concession covering 1,220 square miles in the Keta Basin in southeast Ghana.

Limited production from the Saltpond Oilfield had little effect on the country's importation of crude oil. About 35% of Ghana's foreign exchange revenue was spent for imported fuel. Rationing of gasoline was considered the only method available to reduce consumption; by midyear, a 20% decline in demand from the Tema refinery, the country's sole refinery, was reported.

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[1]Physical scientist, Branch of Foreign Data.

[2]The Financial Times (London). Ghana. No. 28,187, May 13, 1981, pp. I-VI.

[3]Where necessary, values have been converted from the Ghanaian new cedi (Nc) to U.S. dollars at the rate of Nc1 = US$0.36 for 1980.

[4]Daily Graphic (Accra). Bauxite Company-Oil Exploration. Oct. 29, 1980, pp. 1, 4.

[5]West Africa (London). Cause of Gold Production Stagnation Reviewed. Dec. 1, 1980, pp. 2416-2417.

[6]U.S. Embassy, Accra, Ghana. State Department Airgram A-07. Apr. 14, 1981.

The Mineral Industry of Greece

By Roman V. Sondermayer[1]

Greece continued its efforts to develop the mineral industry during 1980. However, the European economic crisis adversely affected output of minerals for export, and consequently, the results of the industry were mixed. Bauxite and various nonmetals remained the major minerals produced in the country. The share of the industry in the gross national product was around 7%, the same level as in previous years. As in the past, the Government of Greece participated in the activities of the mineral industry; it dominated activities in crude oil, lignite, chromite, asbestos, in exploration for all minerals, and in financing new projects.

The major events in the mineral industry during 1980 were as follows: Expansion of alumina plant at Distomon; development of the ferrochrome industry; development and construction of an asbestos mine and plant near Kozáni; decision to build a lead-zinc smelter; and development of an offshore oilfield near the Island of Thassos.

PRODUCTION

The Greek mineral industry was owned both by the Government and by the private sector. The Government acted through publicly owned corporations, of which the ones of principal interest to the mineral industry were Public Power Corp. (PPC); Hellenic Industrial & Mining Co. (HIMIC); the Public Petroleum Co. (DEP); Project Studies and Mining Development Corp., S.A.; the Institute of Geological and Mining Research (IGME); and, for financing, the Hellenic Industrial Development Bank (ETVA). In the private sector, the major mining companies were the Bodossakis Group (nickel, sulfide ores and concentrates, fertilizers, etc.); the Eliopoulou-Kyriacopoulou Group (bauxite, perlite, expanded perlite, bentonite, barite, and kaolin); the Scalistiri Group (magnesite, refractories bauxite, and chromite); Aluminium de Grece S.A. (aluminum); Grecian Magnesite (magnesite); Mykobar S.A. (barite, bentonite); and four companies that shared Greece's cement output, Heracles (known also as General), Titan, Chalkis, and Halyps.

Table 1.—Greece: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite, gross weight ____ thousand tons	2,551	2,984	2,630	2,915	3,286
Alumina, gross weight ____ do	450	474	482	495	494
Metal:					
Primary	133,900	r129,700	143,800	140,830	146,500
Secondary	NA	6,000	5,800	6,500	7,116
Antimony, mine output, metal content	220	--	--	--	--
Chromium:					
Chromite:					
Run-of-mine ore	66,849	72,056	69,000	87,082	77,855
Marketable products:					
Direct-shipping ore[3]	7,381	e8,000	e7,000	e10,000	e8,000
Concentrate	26,908	33,450	32,878	44,767	34,568
Copper, mine output, metal content	2,600	3,500	1,500	--	--
Iron and steel:					
Iron ore and concentrate, nickeliferous:[4]					
Gross weight ____ thousand tons	2,205	2,050	1,685	1,832	1,451
Iron content ____ do	948	881	725	788	624
Metal:					
Pig iron ____ do	400	440	600	328	e350
Ferronickel	60,918	35,593	55,137	54,192	51,407
Crude steel ____ thousand tons	715	759	936	1,000	e1,000
Semimanufactures[5] ____ do	NA	e650	e650	1,450	NA
Lead:					
Mine output, metal content	28,200	16,400	20,300	21,700	20,504
Metal, refined:[6]					
Primary	16,792	14,527	17,014	19,000	21,067
Secondary	1,900	e4,200	e5,600	6,000	4,000
Manganese, gross weight:					
Ore, crude	r58,726	45,287	67,268	68,000	60,050
Concentrate	8,233	7,830	7,010	5,750	5,555
Nickel:					
Ni content of nickeliferous iron ore[7]	r24,255	r22,550	18,535	20,152	15,237
Ni content of alloys	16,448	9,600	14,192	e18,900	13,880
Silver:					
Mine output, metal content thousand troy ounces	1,845	1,070	1,360	1,752	e1,800
Metal content of alloys ____ do	488	e500	e500	e500	NA
Tin metal, secondary	34	e30	e30	e30	e45
Zinc:					
Mine output, metal content	26,473	18,000	25,600	25,700	22,800
Metal, including secondary	e10	e10	--	--	300
NONMETALS					
Abrasives, natural: Emery	6,500	6,500	8,000	9,300	9,300
Asbestos[e]	2,000	35	40	NA	NA
Barite:					
Crude ore	90,620	95,794	110,841	109,344	98,529
Concentrate	43,586	38,579	44,691	48,007	48,200
Cement, hydraulic ____ thousand tons	8,745	10,584	11,280	12,098	e13,150
Clays:					
Bentonite:					
Crude	316,769	419,449	347,617	567,605	501,878
Processed	290,450	336,787	286,435	375,907	362,013
Kaolin:					
Crude	76,725	65,396	49,916	22,991	42,546
Processed	9,865	9,000	12,780	9,485	11,489
Fluorspar, grade unspecified	e1,000	500	610	360	400
Gypsum and anhydrite	444,686	410,000	e430,000	e450,000	e460,000
Magnesite:					
Crude ____ thousand tons	1,284	1,040	820	1,079	1,167
Dead-burned	341,484	350,795	268,258	359,302	397,962
Caustic-calcined	57,456	77,047	92,862	111,070	114,000
Nitrogen: N content of ammonia	238,005	225,000	229,000	287,000	226,000
Perlite:					
Crude	228,081	374,245	223,585	325,098	278,912
Screened	126,732	148,125	134,695	135,495	147,654
Pozzolan (Santorin earth) ____ thousand tons	981	1,256	1,420	1,120	e1,500
Pumice	399,745	568,292	750,152	628,032	e630,000
Pyrite, gross weight	r175,467	128,556	146,870	150,951	147,298
Salt, all types ____ thousand tons	140	190	133	135	121
Silica (probably silica sand)	r16,877	25,448	26,162	27,000	e28,000
Sodium compounds:					
Sodium sulfate	5,435	6,322	6,280	7,610	10,870
Sodium carbonate[e]	1,000	1,000	1,000	1,000	1,000
Stone: Marble ____ cubic meters	170,000	NA	250,000	NA	NA

See footnotes at end of table.

Table 1.—Greece: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sulfur:					
S content of pyrite thousand tons	[r]74	[r]54	61	63	61
Byproduct of petroleum do.	3	3	3	3	4
Talc and steatite	5,543	--	1,078	--	1,460
MINERAL FUELS AND RELATED MATERIALS					
Coal including briquets:					
Lignite thousand tons	22,303	23,572	21,779	23,617	23,207
Lignite briquets do.	50	90	73	70	97
Coke:					
Coke oven do.	337	300	300	[e]310	[e]300
Gashouse do.	12	15	12	15	15
Gas, manufactured:					
Gasworks million cubic feet	274	270	270	10	12
Blast furnace do.	35,308	NA	NA	NA	NA
Coke oven do.	6,353	NA	NA	NA	NA
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	8,424	8,458	10,668	10,812	9,690
Jet fuel do.	4,728	4,504	5,408	10,064	10,632
Kerosine do.	395	326	310	348	333
Distillate fuel oil do.	19,918	20,642	21,559	26,363	27,505
Residual fuel oil do.	35,112	33,087	35,418	46,679	41,772
Lubricants do.	385	467	731	756	535
Other do.	8,523	7,361	6,658	11,759	10,240
Refinery fuel and losses do.	4,248	3,668	4,789	5,852	4,060
Total do.	81,733	78,513	85,541	112,633	104,767

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 15, 1981.

[2]In addition to the commodities listed, a variety of other crude construction materials (clays, sand and gravel, and stone) is produced, but output is not reported and available information is inadequate to make reliable estimates of output levels. Cobalt is also produced and is included with nickel.

[3]Data represent exports.

[4]Ni content is also reported under "Nickel."

[5]Black sheet, galvanized sheet, reinforcing bars, and wire only.

[6]Includes antimonial lead and hard lead.

[7]Also includes Co content.

TRADE

Tables 2 and 3 show the latest trends in trade in minerals.

Table 2.—Greece: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate thousand tons	1,689	1,809	10	U.S.S.R. 642; Romania 574; Netherlands 171.
Oxide and hydroxides	174,355	266,882	--	All to Netherlands.
Metal including alloys:				
Scrap	828	350	--	Italy 286; Saudi Arabia 42; Belgium-Luxembourg 22.
Unwrought	85,275	73,806	--	France 32,161; Italy 23,248; Lebanon 15,311.
Semimanufactures	26,588	30,370	778	Saudi Arabia 6,411; West Germany 4,966; Italy 2,805.
Chromite	20,381	29,140	--	West Germany 17,540; United Kingdom 5,570; Italy 3,200.

See footnotes at end of table.

Table 2.—Greece: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Cobalt oxides and hydroxides	--	18	--	All to United Kingdom.
Copper:				
Matte, speiss, similar materials	40	20	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap	528	161	--	West Germany 65; United Kingdom 55; Spain 40.
Unwrought	300	62	--	United Kingdom 37; Spain 18.
Semimanufactures	3,634	6,279	608	West Germany 1,242; Yugoslavia 934; France 806.
Iron and steel:				
Ore and concentrate excluding roasted pyrite	--	281	--	All to Saudi Arabia.
Roasted pyrite	24,754	50	--	Do.
Metal:				
Scrap	704	511	--	Italy 393; France 70; Netherlands 45.
Pig iron, cast iron, powder, shot	--	20	--	All to Italy.
Ferroalloys: Ferronickel	67,458	65,526	--	West Germany 37,888; France 10,042; Sweden 6,645.
Steel, primary forms	244,484	237,078	--	Italy 215,549; Japan 21,474.
Semimanufactures:				
Bars, rods, angles, shapes, sections	24,134	96,916	--	Egypt 32,944; Cyprus 19,358; Syria 15,697.
Universals, plates, sheets	115,425	47,338	6,000	Yugoslavia 11,067; Turkey 6,340; West Germany 5,745.
Hoop and strip	4,541	4,619	--	West Germany 1,835; China, mainland 909; France 597.
Rails and accessories	19	17	--	Cyprus 16; Saudi Arabia 1.
Wire	1,318	1,369	--	Bulgaria 591; Albania 260; Cyprus 194.
Tubes, pipes, fittings	70,790	94,660	54,523	Albania 11,272; Libya 8,356; Cyprus 4,265.
Castings and forgings, rough	31	30	--	Saudi Arabia 25; Syria 5.
Lead:				
Ore and concentrate	47,795	55,610	--	Romania 22,770; Belgium-Luxembourg 10,400; Italy 9,920.
Metal including alloys:				
Scrap	--	100	--	All to Italy.
Unwrought	1,132	121	--	Turkey 101; France 20.
Semimanufactures	70	16	--	All to Saudi Arabia.
Magnesium metal including alloys, semimanufactures	52	64	--	Italy 34; Spain 18; United Kingdom 12.
Manganese:				
Ore and concentrate	1	200	--	All to Yugoslavia.
Oxides	10,491	15,118	2,919	U.S.S.R. 2,700; United Kingdom 2,033; Belgium-Luxembourg 1,638.
Nickel metal including alloys:				
Scrap	45	--		
Semimanufactures	509	1,056	--	All to Netherlands.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	--	$3	--	All to West Germany.
Silver metal including alloys, unwrought and partly wrought do	--	$1,254	--	All to France.
Tin:				
Ore and concentrate	--	5,365	--	Do.
Metal including alloys, scrap	--	47	--	Mainly to United Kingdom.
Zinc:				
Ore and concentrate	45,005	47,490	--	Italy 14,250; Belgium-Luxembourg 10,000; Bulgaria 8,210.
Metal including alloys:				
Scrap	--	753	--	Italy 673; United Kingdom 60; West Germany 20.
Unwrought and semimanufactures	--	86	--	Saudi Arabia 44; United Kingdom 42.
Other:				
Ores and concentrates	19	8,832	--	Romania 8,400; Saudi Arabia 412.
Ash and residue containing nonferrous metals	161,285	NA	NA	NA.
Waste and sweepings of precious metals value, thousands	$112	--		

See footnotes at end of table.

Table 2.—Greece: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, corundum, etc	359,572	246,545	46,799	United Kingdom 125,059; West Germany 50,000; Canada 17,780.
Dust and powder of precious and semi-precious stones value, thousands	$56	$172	$172	
Grinding and polishing wheels and stones	125	115	--	Turkey 42; Switzerland 23.
Barite and witherite	48,256	38,537	--	Saudi Arabia 14,436; Nigeria 11,271.
Cement thousand tons	4,993	4,271	10	Saudi Arabia 2,239; Libya 380; Algeria 244.
Chalk	56	157	--	Lebanon 156; Cyprus 1.
Clays and clay products:				
Crude clays	345,179	464,076	--	Canada 143,963; Italy 43,081; Netherlands 41,174.
Products:				
Refractory including nonclay brick	25,442	41,261	(1)	Romania 7,179; Bulgaria 6,373; Qatar 4,354.
Nonrefractory	9,606	14,382	17	Saudi Arabia 7,275; Cyprus 3,587.
Fertilizer materials, manufactured:				
Nitrogenous	60	2	--	All to Saudi Arabia.
Phosphatic	2,988	NA	NA	NA.
Potassic	--	200	--	All to Jordan.
Other including mixed	6,407	15,402	10,500	Belgium-Luxembourg 4,850; Saudi Arabia 52.
Graphite, natural	450	--		
Gypsum and plaster	5,622	6	--	Syria 3; Cyprus 2.
Lime	4,518	3,160	--	Saudi Arabia 2,630; Libya 530.
Magnesite	366,956	476,814	5,432	West Germany 97,673; Italy 70,359; United Kingdom 45,921.
Pigments, mineral: Processed iron oxides	--	1	--	All to Saudi Arabia.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	31,734	39,852	184	Italy 8,527; Lebanon 7,340; Saudi Arabia 6,337.
Worked	18,504	20,262	7	Saudi Arabia 8,753; West Germany 4,930; Kuwait 1,276.
Gravel and crushed rock	6,003	13,719	--	Libya 11,929; Kuwait 1,000; Jordan 770.
Quartz and quartzite	26,062	18,420	--	Norway 9,300; Sweden 9,100; Lebanon 20.
Sulfur:				
Elemental, other than colloidal	20,259	10,756	--	Turkey 5,723; Egypt 4,708.
Sulfuric acid oleum	87,253	26,637	--	Turkey 20,035; Yugoslavia 2,969; Libya 1,240.
Talc, steatite, soapstone	50	1,405	--	Israel 1,100; Cyprus 285; Libya 20.
Other:				
Meerschaum, amber, jet	14,910	NA	NA	NA.
Unspecified	221,301	224,084	--	West Germany 93,779; France 40,410; United Kingdom 23,716.
Slag, dross, and similar waste, not metal-bearing	5,732	18,367	--	Norway 14,800; Israel 900; Italy 877.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	4,935	8,802	--	France 8,308; Hungary 494.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals	53,103	34,339	--	Saudi Arabia 14,641; Libya 6,511; Cyprus 4,231.
MINERAL FUELS AND RELATED MATERIALS				
Coal and briquets: Lignite	5	21	NA	NA.
Coke and semicoke	47,792	38,123	--	All to Spain.
Hydrogen, helium, rare gases	46	NA	NA	NA.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	4,508	2,322	(1)	Netherlands 733; United Kingdom 636; Lebanon 534.

See footnotes at end of table.

Table 2.—Greece: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products —Continued				
Kerosine and jet fuel thousand 42-gallon barrels	3,158	1,297	539	Netherlands 101; United Kingdom 91.
Distillate fuel oil do	2,067	3,211	1,216	Netherlands 593; Saudi Arabia 407; France 173.
Residual fuel oil do	8,452	9,699	19	Italy 3,953; Turkey 2,163; Netherlands 1,128.
Lubricants do	596	473	144	Egypt 227; United Kingdom 24.
Other:				
Liquefied petroleum gas do	206	326	--	Syria 169; Lebanon 79; Egypt 62.
Mineral jelly and wax do	16	82	12	Morocco 57; West Germany 12.
Bitumen and other residues do	309	307	--	Libya 292; Lebanon 13.

NA Not available.
[1]Less than 1/2 unit.

Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	1,057	5,878	--	Italy 5,836; France 15.
Oxide and hydroxides	568	633	44	West Germany 287; France 201.
Metal including alloys:				
Scrap	--	62	--	All from Saudi Arabia.
Unwrought	451	367	(1)	France 133; United Kingdom 118.
Semimanufactures	3,002	3,574	159	West Germany 1,452; Italy 798; France 430.
Chromium:				
Chromite	922	2,450	--	All from Republic of South Africa.
Oxides and hydroxides	176	128	1	West Germany 67; East Germany 21; United Kingdom 17.
Cobalt:				
Oxides and hydroxides value, thousands	$3	$12	--	Belgium-Luxembourg $7; United Kingdom $5.
Metal including alloys, all forms	5	--		
Copper:				
Oxides and hydroxides	44	--		
Sulfate	1,207	NA	NA	NA.
Metal including alloys:				
Scrap	193	255	3	Libya 188; Saudi Arabia 62.
Unwrought	21,885	24,732	101	Yugoslavia 6,793; Belgium-Luxembourg 6,712; Chile 1,617.
Semimanufactures	873	1,092	29	West Germany 348; France 205; Italy 125.
Iron and steel:				
Ore and concentrate	235,127	390,591	--	Republic of South Africa 341,742; Liberia 48,838.
Metal:				
Scrap	198,132	231,286	180,650	Bulgaria 21,334; Canada 20,441.
Pig iron including cast iron	15,275	15,014	NA	U.S.S.R. 12,475; West Germany 1,451.
Sponge iron, powder, shot	353	566	3	France 210; Italy 210; United Kingdom 58.
Ferroalloys	10,442	15,229	24	Portugal 7,377; France 3,202.
Steel, primary forms	699,592	385,438	14,840	Brazil 113,722; Japan 93,199; France 84,010.

See footnotes at end of table.

Table 3.—Greece: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	217,459	217,111	25	France 56,906; Czechoslovakia 32,690; Italy 29,385.
Universals, plates, sheets	19,664	180,859	1,483	Japan 36,000; West Germany 29,694; Czechoslovakia 20,952.
Hoop and strip	117,522	97,046	445	West Germany 40,494; France 16,238; Bulgaria 12,888.
Rails and accessories	1,210	24,735	12	France 17,926; West Germany 3,379.
Wire	7,908	7,408	(1)	West Germany 2,217; Belgium-Luxembourg 1,482; Italy 1,438.
Tubes, pipes, fittings	29,304	31,524	891	West Germany 13,873; Italy 3,943; France 3,585.
Castings and forgings, rough	2,054	1,222	3	Belgium-Luxembourg 537; Italy 330; France 217.
Lead:				
Ore and concentrate	--	3,468	--	All from Ireland.
Oxides and hydroxides	246	115	--	France 94; West Germany 12; United Kingdom 8.
Metal including alloys:				
Unwrought	5,685	4,966	(1)	Tunisia 1,506; Bulgaria 1,382; Morocco 999.
Semimanufactures	20	11	--	Netherlands 6; West Germany 5.
Magnesium metal including alloys, all forms	429	521	70	France 376; Norway 61; Italy 10.
Manganese:				
Ore and concentrate	7,429	4,726	--	Gabon 4,721; West Germany 5.
Oxides and hydroxides	37	54	--	All from Belgium-Luxembourg.
Metal including alloys, all forms	151	--		
Nickel metal including alloys:				
Scrap	--	2	--	All from West Germany.
Unwrought	225	176	--	Canada 116; Netherlands 17; United Kingdom 17.
Semimanufactures	84	67	(1)	United Kingdom 27; West Germany 20.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$934	$2,535	$572	Switzerland $660; West Germany $555.
Silver metal including alloys, unwrought and partly wrought ——do——	$20,015	$17,713	$218	France $7,001; United Kingdom $5,872; West Germany $3,271.
Tin metal including alloys:				
Unwrought	320	799	2	Bolivia 338; Belgium-Luxembourg 140; Malaysia 103.
Semimanufactures	--	15	1	West Germany 9; Netherlands 3; United Kingdom 2.
Titanium oxides	1,138	837	(1)	West Germany 366; France 313; Belgium-Luxembourg 108.
Zinc:				
Oxide and hydroxides	578	--		
Metal including alloys:				
Scrap	117	43	7	Switzerland 33; United Kingdom 2.
Unwrought	15,886	20,942	--	Belgium-Luxembourg 3,738; Netherlands 3,714; West Germany 3,109.
Semimanufactures	105	189	(1)	Belgium-Luxembourg 72; Norway 42; West Germany 23.
Other:				
Ores and concentrates	5,809	--		
Metals:				
Metalloids	430	551	--	France 526; Belgium Luxembourg 12; West Germany 12.
Alkali, alkaline-earth, rare-earth metals	(1)	1,609	--	West Germany 1,315; France 294.
Base metals including alloys, all forms	234	170	1	France 141; West Germany 9.
NONMETALS				
Abrasives, n.e.s.:				
Natural	36	8	4	Italy 1; United Kingdom 1; West Germany 1.
Artificial corundum	443	606	--	West Germany 372; France 110; Italy 95.

See footnotes at end of table.

Table 3.—Greece: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Abrasives, n.e.s. —Continued				
Dust and powder of precious and semiprecious stones value, thousands	$2,505	$2,410	$786	West Germany $464; Ireland $313; Italy $48.
Grinding and polishing wheels and stones	260	346	6	Italy 139; Austria 48; Poland 40.
Asbestos, crude	14,756	15,214	--	Canada 4,116; Cyprus 3,526.
Barite and witherite	39	110	--	Turkey 63; West Germany 46.
Boron materials:				
Crude natural borates	503	501	--	All from Turkey.
Oxide and acid	470	443	NA	Romania 150; France 98; U.S.S.R. 76.
Chalk	1,004	971	--	Austria 424; United Kingdom 187; Turkey 172.
Clays and clay products:				
Crude	51,104	76,323	1,145	United Kingdom 45,844; Czechoslovakia 8,944; Yugoslavia 6,974.
Products:				
Refractory including nonclay brick	24,361	32,783	178	West Germany 8,235; Austria 6,140; France 4,964.
Nonrefractory	30,612	45,860	1	Italy 44,937; West Germany 514.
Cryolite and chiolite, natural	(1)	5	--	Mainly from Denmark.
Diatomite and other infusorial earth	589	677	224	West Germany 204; Italy 120.
Feldspar and fluorspar	11,850	20,644	--	Kenya 7,525; Italy 6,531; Norway 4,502.
Fertilizer materials:				
Crude:				
Phosphatic	99,064	82,864	--	Morocco 41,963; Tunisia 29,159; Israel 11,742.
Potassic	10,547	--		
Other including mixed	150	--		
Manufactured:				
Nitrogenous	113,138	124,421	--	Italy 36,565; Romania 36,238; Bulgaria 34,804.
Potassic	20,803	9,127	--	West Germany 3,919; Belgium-Luxembourg 3,005; Italy 1,800.
Other including mixed	709	289	NA	West Germany 143; Israel 51; Netherlands 42.
Ammonia	58,583	82,294	--	Libya 47,686; U.S.S.R. 14,881.
Graphite, natural	233	154	--	Czechoslovakia 55; Austria 30; Italy 30.
Gypsum and plaster	1,165	1,339	--	Italy 685; West Germany 401; Switzerland 168.
Magnesite	669	457	--	Austria 305; Netherlands 48; West Germany 38.
Mica:				
Crude including splittings and waste	117	173	--	Austria 75; United Kingdom 25; Netherlands 20.
Worked including agglomerated splittings	7	26	--	United Kingdom 20; Belgium-Luxembourg 2; Japan 2.
Pigments, mineral: Processed iron oxides	1,833	2,279	--	West Germany 1,821; United Kingdom 174.
Precious and semiprecious stones, excluding diamond value, thousands	$239	$564	$3	Belgium-Luxembourg $390; West Germany $34.
Pyrite (gross weight)	18,944	14,414	--	All from Cyprus.
Salt	42,928	7,469	NA	Romania 6,277; Italy 1,011.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	40,293	50,957	--	France 48,885; Italy 1,853.
Caustic potash	100	256	--	Italy 124; West Germany 63; Spain 40.
Soda ash	40,068	33,872	--	Bulgaria 12,990; Belgium-Luxembourg 7,999; Netherlands 4,747.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	4,827	10,780	--	Italy 8,721; Pakistan 813; Turkey 120.
Worked	855	640	--	Italy 576; Argentina 17; Mexico 17.

See footnotes at end of table.

Table 3.—Greece: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory grade	1,169	1,632	--	Italy 1,404; Norway 59; Spain 49.
Gravel and crushed rock	776	665	--	France 466; Belgium-Luxembourg 103.
Quartz and quartzite	1,070	449	--	Italy 217; Belgium-Luxembourg 196.
Sand excluding metal-bearing	144,391	111,930	3	Belgium-Luxembourg 99,998; Bulgaria 4,433; Netherlands 3,922.
Sulfur:				
Elemental:				
Other than colloidal	81,004	58,084	--	Poland 29,396; France 28,648.
Colloidal	113	340	--	France 327; West Germany 13.
Sulfuric acid, oleum	16,467	15,754	--	West Germany 11,386; Italy 4,360.
Talc, steatite, soapstone, pyrophyllite	1,914	2,565	58	France 1,024; Belgium-Luxembourg 946; Italy 187.
Other:				
Crude	1,048	968	26	Gabon 202; Denmark 91; Netherlands 91.
Slag, dross, and similar waste, not metal-bearing	1,618	2,910	--	United Kingdom 1,896; Belgium-Luxembourg 970; West Germany 22.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	152	179	10	France 52; Italy 34; United Kingdom 29.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals	1,928	3,658	--	France 2,326; Italy 856; Romania 288.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	8	20	20	
Carbon black	2,193	1,437	5	Italy 769; West Germany 363; France 112.
Coal, all grades including briquets	375,889	454,620	--	Australia 237,199; Poland 192,810; U.S.S.R. 21,636.
Coke and semicoke	24,167	73,033	--	Australia 28,890;Italy 27,474; Czechoslovakia 14,153.
Hydrogen, helium, rare gases	556	516	(1)	Bulgaria 440; West Germany 32.
Peat including briquets and litter	2,054	3,560	--	U.S.S.R. 2,266; Netherlands 642; Poland 414.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	90,539	114,078	--	Saudi Arabia 34,743; Egypt 24,332; Iraq 16,102; Tunisia 10,957.
Refinery products:				
Gasoline do	1,836	165	(1)	Israel 105; United Kingdom 53.
Kerosine and jet fuel do	1,885	1,082	(1)	France 604; Italy 439; United Kingdom 14.
Distillate fuel oil do	4,158	1,006	--	U.S.S.R. 409; Italy 376; France 78.
Residual fuel oil do	3,164	3,438	--	Italy 1,015; France 554; Bulgaria 533.
Lubricants do	488	489	6	Netherlands 241; Italy 74; United Kingdom 64.
Mineral jelly and wax do	8	10	(1)	West Germany 6; Hungary 1.
Other:				
Liquefied petroleum gas do	249	7	(1)	Mainly from Italy.
Pitch and pitch coke do	89	89	--	France 47; Italy 34.
Petroleum coke do	352	318	141	Italy 72; France 69.
Bitumen and other residues do	133	283	--	Albania 282.
Bituminous mixtures do	2	2	(1)	United Kingdom 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4,504	5,502	10	Netherlands 1,483; Egypt 1,126; United Kingdom 1,052.

NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—No major developments were made public in the bauxite producing sector of the mineral industry of Greece. Bauxites Parnasse Mining Co. S.A. remained the leading producer and, during the year, continued to expand its underground mines in the Parnassos-Ghion area. The second largest bauxite producer was Eleusis Bauxite Mines, Mining-Industrial & Shipping Inc., which operated mines near Eleusis, Lamia Itea, and Kymi.

Aluminium de Grece S.A. (AG) started preparing for expansion of its alumina plant at Distomon, Boeotia, from an annual capacity of 500,000 to an annual capacity of 600,000 tons. However, some difficulties created by high prices that the Government of Greece intended to charge for additional power delivered to Distomon were not resolved at the yearend. Attempts of Greek authorities to find a partner for another alumina plant in Greece were not successful during 1980. After a visit by a Greek Government delegation to Moscow, the Greek and Soviet negotiators reached agreement on another feasibility study for the new alumina plant.

Chromite.—Hellenic Ferro-Alloy S.A., a subsidiary of HIMIC, continued with preparations for construction of a 30,000-ton-per-year ferrochrome plant. During 1980, plant equipment was ordered and some preliminary construction work started on the plant site near Volos. The principal contractor for plant know-how was Outokumpu Oy of Finland. While the ferrochrome project was underway, HIMIC was preparing feasibility studies for development of stainless steel producing facilities that will use ferrochrome produced at Volos.

The ore base for plant operations was chromite deposits on Vourinos Mountain, near Kozáni. Hellenic Ferro-Alloys S.A. owned about 80% of the concession area. The major producer of chromite in the area was the Xeralivado Mine, located 1,000 meters above sea level southwest of the town of Kozáni. Mining was underground, using sublevel caving and shrinkage stoping in areas where the ore is subvertical, and room and pillar in near vertical lenses. During 1980, development of the deeper section of the mine continued. A new adit was being driven on the 700-meter level to enable construction of shafts for haulage, ventilation, and dewatering. In the central section of the mine, plans called for construction of a spiral ramp to link levels at 868 meters and 850 meters.

The nearby mill processed about 180 to 200 tons of ore per day with an average of 16% Cr_2O_3. Output of the mill was 45 tons of concentrates containing about 52% Cr_2O_3. The recent introduction of heavy media separation has improved the performance of the concentrator. Expansion of the plant was planned during 1980 to a capacity of 600 tons of ore per day.

Gold.—After 5 years of exploration by the geologists of IGME in northern Greece, an alluvial gold deposit discovered in the area apparently warranted construction of a pilot plant near Nigrita, Serrai. Reserves of the area were reported to be about 12 tons of gold. Mining for gold in Greece has a long history. Archaeological works have identified about 21 old gold mining sites in Greece, mostly in areas of Mount Panagion, the Krousia Range, the Gallikos River, Anagista, the Vermion and Pieria Mountains, and on the Island of Thassos.

Iron and Steel.—Halyvourgiki S.A., the only integrated steel producer in the country, placed an order with Danieli for a new bar-and-rod mill for its plant at Eleusis. The capacity of the mill was reported at 230,000 tons per year of 120-square-millimeter continuously cast billets, 8- to 26-millimeter-diameter round bars, and 5.5- to 12-millimeter-diameter wire rods.

Lead and Zinc.—Greece decided to implement its plan to build a lead-zinc smelter located in northern Greece. A feasibility study was prepared by Stolberg Zinc Co. of the Federal Republic of Germany and Imperial Smelting Processes Ltd. of the United Kingdom. The project calls for an Imperial smelter with an annual capacity of 60,000 tons of zinc, 30,000 tons of lead, plus by-product silver and gold. A 600,000-ton-per-year sulfuric acid plant was included in the project. Total investments were reported at US$300 million. ETVA's subsidiary, Hellenic Metals S.A., organized in the spring of 1980, should carry out construction and should operate the facility after completion.

During 1980, the largest producers of lead and zinc concentrates remained the Kassandra lead and zinc mines on the Chalkidiki Peninsula, operated by Hellenic Chemical Products and Fertilizers. The mines were located near the coast on the Gulf of Ierissos. The main concentrator and the ship-loading facilities were located at Stratonion. One of Kassandra's mines, Olimpia, was

being modernized, and it is expected that the modernization, when completed in 1983, will increase mine capacity to 800,000 tons per year.

Nickel.—The world economic conditions affected Larco S.A.'s nickel operations during 1980. Production of ore was down and exports were lower than in recent years.

NONMETALS

Asbestos.—Development of an asbestos mine and construction of a 100,000-ton-per-year asbestos processing plant continued at Zidani, south of Kozáni, a town in north-central Greece. The property was discovered in 1936 and after being owned by the Kennecott Copper Corp. and Cerro Corp., both of the United States, was taken over by the Greek Government through its company, Asbestos Mines of Northern Greece, Mining S.A. (MABE). Reportedly production should start early in 1981.

The asbestos deposit on which the operation of the mine and the plant is based is large by European standards. Proven reserves were reported at 90 million tons with an average fiber content of 2.63%; about 40 million tons of ores with an average content of fiber of 3% were known to exist below level 500. Some cores from exploratory holes drilled below level 450 indicated the existence of zones of mineralization with higher content of fiber than in more shallow zones.

The mine will be open cast, with vertical benches 10 meters high. Blasting is necessary and 7-inch holes will be drilled on a 10-meter by 10-meter grid. Ammonium nitrate and fuel oil was planned as the blasting agent. For drilling blasting holes Schram C-64-C drills were purchased; two Caterpillar wheel loaders 992 C with 10-cubic-meter buckets and two hydraulic O and K power shovels RH 75 equipped with 7.6-cubic-meter shovels will be used for loading, and five 80-metric-ton Caterpillar 777 trucks will be used for moving ore and overburden.

Magnesite.—During 1980, Greece remained a net exporter of magnesite and magnesite refractories, but activities of the sector were adversely affected by the slump in economic activities in general, and in particular by difficulties faced by steel producers in Europe.

Grecian Magnesite Ltd. S.A. and Ore Sorters of Canada, a subsidiary of the Rio Tinto Ore Sorters Group, signed a contract for the supply of three Model 16/80 photometric sorters. The new machines will be used in the existing sorter installations at Gerakini Mines in northern Greece.

Perlite.—Based on a possibility of expanded exports to the Middle East, Silver and Barites Ores Mining Co. decided to expand its perlite mining capacities, on the islands of Milos and Kos, from 125,000 tons per year to 180,000 tons per year at a cost of US$2.5 million.

MINERAL FUELS

Lignite.—The only fuel produced in Greece remained lignite. Most of the lignite was mined at Aliveri (Euboea), Ptolemais (near Kozáni), and Megalopolis (central Peleponnesus), and used by the PPC to fuel nearby power stations.

In 1980 PPC continued work on opening the Ptolemais south field. Plans called for the field to produce sufficient lignite to supply seven 300-megawatt power units in the area. In addition, work was underway to construct a pilot plant to test making cement with the lignite ash.

During 1980, no major discoveries were made public in the joint exploration for lignite conducted by PPC and IGME.

Petroleum and Natural Gas.—Greece was not a producer of natural gas and crude oil. However, development of the offshore oil and gas fields of Prinos and Kavalla near the Island of Thassos in the north Aegean Sea were close to completion, and consequently Greece should become a producer of crude petroleum and natural gas during 1981.

During 1980, development of the Prinos offshore oilfield continued. Two of the three planned shore production platforms were in place. The net pay totaled 500 feet (about 150 meters) and expected production was estimated to be between 20,000 and 25,000 barrels per day of 28° API oil. The undersea pipeline from the Prinos Field to Kavalla on the mainland was also completed, and construction started on a crude oil storage facility with a capacity of 250,000 barrels (about 40,000 cubic meters). Reserves in the Prinos Field were estimated to be between 70 million barrels and 140 million barrels and the life of the field was set between 10 and 15 years. Development costs were reported at US$500 million with unit costs amounting to almost double that of the North Sea.

The Kavalla South Gasfield was expected to produce about 18 million cubic feet per day and 1,000 barrels of condensate per day.

The fields were operated by North Ae-

gean Petroleum, acting for a consortium of the following companies: Denison Mines, 68.8%; Hellenic Oil, a subsidiary of Fluor, 14%; Wintershall, 12.5%; and White Shields, 4.7%. The concession was renegotiated, and the new agreement gives the state an enhanced 65% share of net profits from production after recovery of development costs.

While the private consortium was preparing for production, the state-owned petroleum company, DEP, continued exploration for oil and gas on its own account, mostly by using contractors. In addition, DEP was planning future exploration, chiefly in areas away from the disputed central and eastern Aegean Sea, reported to be as follows: (1) Northwestern Peloponnese (onshore) and Gulf of Patras (offshore). (2) Plain of Thessaloniki-Katerini (Macedonia). (3) Strimon River Valley (Macedonia). (4) Gulf of Kyparissia (onshore and offshore), western Peloponnese. (5) Offshore of the islands of Zakinthos and Keffalinia, Ionian Sea. (6) Offshore western Epirus, Ionian Sea. (7) Offshore to the northwest of the Island of Corfu, Ionian Sea. (8) From Grevena to Meteora, in the interior of north-central Greece. (9) River Evros estuary (Thrace), close to the border with Turkey.

Uranium.—During 1980, geologists and geophysicists from the Democritus Research Center continued to explore for uranium in Macedonia and Thrace. In addition, IGME continued uranium exploration in Epirus with cooperation from scientists at Democritus. Apparently no major uranium discoveries were made during the year.

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[1]Physical scientist, Branch of Foreign Data.

COMMODITY REVIEW

METALS

Hungary has limited economic reserves of ore for a number of metals. These include aluminum, copper, gallium, iron, lead, manganese, molybdenum, vanadium, and a few other rare metals. Production of many metals is not sufficient for domestic needs, and Hungary must rely on imports. Although prospecting for nonferrous metals was conducted in 1980, no significant finds were reported.[7]

Despite increased efforts to economize on the use of raw materials, the metallurgical industry is not endowed technologically for maximum processing of scrap, and therefore Hungary exports large amounts of high-quality aluminum, copper, steel, and other metallic scrap.

Aluminum.—Hungarian bauxite production ranks third in Europe and eighth in the world. Bauxite reserves are reportedly estimated at 200 million tons of 52% Al_2O_3, and are located in five regions at a depth of 100 to 300 meters. Of bauxite production, 80% is processed domestically, and 20% is exported.

Hungary occupies the 6th place in Europe and the 12th in the world in alumina production. However, in aluminum output Hungary is neither a European nor a world leader because metal producing electrolysis capacity is low and the pots are obsolete. Aluminum production methods are not efficient and have been termed environmentally objectionable. Also, metal refining technology is not advanced, and semimanufactures rank near the bottom of world market specifications.[8]

Regarding new development, construction was completed of the Ajka alumina plant and the Deaki Mine. The Ajka plant was the aluminum industry's biggest investment project and is to increase the production of alumina by 80,000 tons annually. This goal is being gradually achieved. The Deaki Mine has an annual capacity of approximately 600,000 tons of bauxite.

It was announced that the development of a new bauxite mine at Fenyofo is underway. The mine is to produce 1 million tons per year, and development time is expected to be 5 years. The mine is projected to reach its design capacity by 1988. In 1980, it was reported that Hungary purchased a fully automatic computer-controlled rolling mill installation from Japan's Nissho-Iwai Co. Ltd. for the Szekesfehervar light metal works. The contract was valued at $11 million, and the installation is scheduled to go into operation in 1981. Payment is to be made in part by delivery of 40,000 tons of aluminum products. Japanese engineers are to supervise the erection and test runs.

As part of an administrative reorganization, three enterprises (Hodmezovasarhely, Balassagyarmat, and Zalaegerszeg), formerly under local control, were put under the administration of the Hungarian Aluminium Corp., Magyar Aluminiumipari Troszt (MAT).

Hungary has only one secondary aluminum smelter, the Qualital smelter, that produces approximately 20,000 tons of secondary aluminum. Current scrap collection brings in approximately 25,000 tons per year, much of which is exported. A new shredder is to be installed at the Qualital smelter to improve performance. Exports of scrap are to be replaced by exports of alloy and foundry ingots. The sixth 5-year plan envisages a rise in the amount of aluminum scrap processed to 27,500 tons per year by 1985.

Future plans also call for a 40% to 50% increase in bauxite exploration drilling. New bauxite mines are to be opened to meet production targets. The newly explored deposits at Nagyegyhaza, Bakonyoszlop, Iharkut, and Nyirad, containing high-grade bauxite, have substantial potential reserves.

Casting capacity is to be increased by 3,000 tons per year upon the 1982 scheduled completion of the foundry at the Ajka plant. Construction is planned for a new aluminum smelter with a capacity of 100,000 tons per year. Discussions are being conducted with U.S., Japanese, and French firms concerning the construction of the new smelter.

Copper.—The Hungarian copper industry uses primarily imported raw materials. However, it is claimed that the Recsk copper deposit discovered in 1972 is one of the world's largest. In 1980, prospecting at the Recsk deposit was declared almost complete. The ore body is more than 3,000 feet below the surface, and the copper content is about 1%. Plans are to develop mining, concentrating, and smelting facilities, and negotiations are being conducted with foreign firms to establish cooperative ventures for this development. Initial processing capacity is planned to be approximately 2.5 million tons of ore annually with eventual capacity to reach 5 million tons.

Copper content of collected copper and copper alloy scrap amounts to approximate-

ly 15,000 tons per year. Processed scrap that is not exported is used by the Csepel metallurgical works except for about 1,000 tons that goes to a foundry at Mosonmagyarovar. There has been an increase in foreign trade activity to provide for domestic copper requirements because of the closing in 1978, for stated environmental reasons, of a shaft furnace treating copper scrap at the Metallochemia plant, a part of the Csepel works.

Gallium.—In 1980, gallium output was to increase at the newly reconstructed Ajka alumina plant. Exports were predicted to be 1.5 tons.

Gold.—Hungary's only gold mine at Recsk is being depleted. Plans are to increase production of metal from scrap. It was announced that a process has been patented in Hungary for obtaining gold from scrap. Using this process, it is said to be possible to recover 6 grams of gold from 1 kilogram of scrap, and to recover gold of 95% purity from complex alloys. Also, the Rubbish Collection Trust announced that one of its enterprises is to begin production of gold bars.

Iron and Steel.—In 1980, production of iron ore, total pig iron, crude steel, and steel semimanufactures declined compared with the 1979 level. In 1980, labor productivity in the steel industry was quite low, being one-seventh of that in Japan.[9]

In 1980, foreign trade turnover in steel declined by 17.5% with exports falling 17% and imports by 18.1%. The domestic price of iron and steel products rose by 28% to 29% for the year. The number of workers in the steel industry declined to 76,351. The Csepel metallurgical works reported a serious labor shortage with an 18% vacancy rate that jeopardized production.[10]

Domestic raw materials supply only a fraction of ferrous metallurgy requirements. Imports provide all of the ferromanganese, almost all of the iron ore, and the majority of the coke. In 1980, the Martin process accounted for over 90% of steel production, and electric, the bulk of the remainder. Owing to insufficient production of high-quality steel, the machine building industry is forced to use imported steel even though the ferrous metallurgy industry exports 30% of its products. Despite its need for advanced technology and equipment to upgrade the ferrous industry, Hungary is limited in what it can afford and must be highly selective in its development policy.[11]

The Rudabanya Mine supplies all of Hungary's iron ore in the form of limonite and siderite. Ore is treated near the mine using magnetic separation and sintering. In an effort to boost iron ore production, techniques are being examined to recover the iron from bauxite. Consideration is also being given to other domestic iron ores neglected in the past because of their low iron content.

During 1980, construction of the oxygen converter shops continued at the Lenin metallurgical works in Diosgyor and at the Danube ironworks in Dunaujvaros. The first converter at the Lenin works was commissioned in 1980. It is an 80-ton converter and has a rated annual capacity of 700,000 tons. The converter at the Danube works is scheduled for commissioning in the second half of 1981. Also, finishing facilities are to be installed at the Lenin and Danube works. Two Japanese firms, Kobe Steel Ltd. and Nippon Kokan, K.K., have contracted to supply the Lenin works with an electric arc furnace with a rated output of 220,000 tons per year, and with a continuous casting machine with a 350,000-ton-per-year capacity.

The present blast furnaces and steelmaking facilities at the Lenin works are not considered modern. The blast furnaces are small and obsolete and the open-hearth plant has been termed "uneconomical, obsolete, and hazardous." As part of a renovation program, blast furnace No. 2 was rebuilt in 1980. Renovation of blast furnace No. 3, supplying approximately 55% of total output, was scheduled to begin in July 1980. Blast furnace No. 3 is to be expanded to provide 70% to 75% of plant output, and is to supply predominantly the new oxygen converter plant.[12]

At the Danube works a third continuous casting unit is to be built, and plans are to modernize the existing casting plant. A coking facility at the Danube works is scheduled for completion by 1985.

Other development plans for the sixth 5-year plan call for the modernization of two blast furnaces at the Ozd metallurgical works and the construction of a new pipe mill at the Csepel metallurgical works.

By 1985, crude steel production is projected to reach 4.3 to 4.5 million tons per year, and rolled steel, 3.4 to 3.6 million tons per year. Investment in ferrous metallurgy is to be greater than during the fifth 5-year plan. Problems procuring coke and alloying materials are expected to persist into the sixth 5-year plan.

Lead and Zinc.—The mine output of lead and zinc rose slightly in 1980 as did concentrate production. Production of lead concentrate equaled 2,081 tons, and zinc concentrate, 5,443 tons.

In 1980, Hungary's only major lead-zinc mine at Gyongyosoroszi in the Matra Mountains supplied 145,000 tons of lead and zinc ore. Lead and zinc production can increase because the copper deposits under development at Recsk contain economically recoverable quantities of lead and zinc.

At present, large metal imports are required to meet lead and zinc consumption needs. Annual lead consumption is approximately 20,000 tons. The battery industry consumes about 60% of the lead supply and is also the major supplier of secondary lead. In conjunction with the campaign to increase secondary recovery, complaints were raised that automobile owners are still discarding their old batteries, and a trade-in system is to be established. Under optimum conditions it is estimated that 13,000 tons of lead in battery scrap could be collected annually.

The major problem in scrap processing is the lack of a smelting facility. When the shaft furnace at the Metallochemia plant of the Csepel works was closed in 1978 for claimed environmental reasons, production of lead from battery scrap virtually ceased. The lead scrap is now exported. In 1980, approximately 10,000 tons of lead scrap was exported, 40% of which Hungary exported to the German Democratic Republic under an arrangement to have it smelted there. Besides the German Democratic Republic, Italy is a major European importer of Hungarian lead scrap. The problem of processing battery scrap in the future is to be solved by either setting up a new smelting facility or by making further arrangements for processing abroad.

Also, owing to low production and a subsequent lack of processing facilities, Hungary exports zinc concentrates and zinc scrap and meets consumption needs with imported metal.

Manganese.—Hungary has substantial reserves of manganese ore, the majority of which is carbonated and a smaller percentage oxidized. Carbonated manganese ore reserves are estimated at 100 million tons, but owing to a lack of processing capacity it can be extracted only in small quantities. Reserves of oxidized manganese ore are estimated at 25 to 30 million tons. This amount is deemed sufficient beyond the year 2000. Despite production of oxidized manganese ore, Hungary, at present, produces no ferromanganese. Annual consumption of ferromanganese is approximately 50,000 tons, which is imported from both the non-market-economy countries and the market-economy countries.

NONMETALS

The demand for a number of nonmetallic minerals is satisfied by domestic production, and several of these minerals are exported. Industrially important deposits of nonmetallic minerals (bentonite, diatomite, illite, kaolin, perlite, zeolite, etc.), are concentrated in the Tokaji Mountain area where 12 mines supply 13 types of minerals. In 1980, there were recorded production increases for bentonite and perlite and decreases for cement, kaolin, and lime.

Cement.—Cement production declined in 1980 after years of steadily increasing production. It was reported that the Labatlan reinforced concrete works was enlarged, and production is expected to greatly increase.

In conjunction with the policy of energy conservation, the cement plant under construction in Belapatfalva is to use the dry processing method.

Diatomite.—The new diatomaceous earth calcination plant that was put into operation in mid-1979 at Erdobenye in the Tokaji Mountain region is reported producing 20,000 tons per year.

Fertilizer Materials.—Less fertilizer was consumed in 1980 than in 1979, and there was not always the desired selection. Demand for granular rather than powder form potassic and phosphatic fertilizers exceeded supply. It was stated that during the sixth 5-year plan there is no need for additional production capacities for nitrogenous fertilizers because demand for additional fertilizer is to be provided by imports from the Soviet Union through the framework of a broadened agrochemical agreement.[13] However, it has been deemed advisable to modernize outdated superphosphate plants and to increase the selection of specialized fertilizers. Demand is emerging for liquid chemical fertilizers, but conversion to liquid fertilizers has to be gradual because neither industry nor agriculture possesses the necessary equipment for production or application.

The Pet nitrogen works is currently producing over half of Hungary's fertilizer production, including almost three-fourths

of the country's nitrogen fertilizer production. Approximately 4,500 persons are employed at the Pet works. During the sixth 5-year plan, it is planned to construct an argon plant at the Pet nitrogen works that will make use of waste gases from the Pet works. By improving efficiency at the Pet works, urea production is expected to double, and there is to be a significant increase in fertilizer production.

Limestone.—Limestone is one of the nonmetallic minerals that Hungary is able to produce in quantities sufficient for domestic consumption and for export. Limestone quarrying has been conducted in the Transdanubian Uplands, and the Mecsek, Cserhat, and Bukk Mountain regions since ancient times. The "red marble" limestone of the Gerecse Mountain region is a popular decorative building material. Freshwater limestone is quarried around Budapest as well as in the Gerecse Mountain region.

Sand.—Almost all sand for Hungarian glassworks comes from the Fehervarcsurgo operation in the Transdanubian Uplands, and in 1980, there was a reported increase in glass sand production. Sand suitable for foundry use is in deposits in the Pannonian Basin. Sand and gravel for the construction industry is obtained from alluvial fans, river sediment, flood plains, and terraces. A significant amount is obtained from dredging existing river channels.

Zeolite.—Total zeolite resources are estimated at 100 million tons. A new zeolite plant with a production capacity of 10,000 to 15,000 tons per year was recently built as part of the Mad enterprise.

MINERAL FUELS

Hungary's short supply of energy and the continuous rise in energy prices are considered permanent facts. The country depends on imports of oil, natural gas, and electric power for over half of its energy needs. Coal is the only energy resource available in large quantities, and it is composed mainly of brown coal of low calorific value. Owing to the lowland nature of the country and the absence of fast rivers, possibilities for utilizing hydroelectric power are limited. During the 1980's, increasing electric energy requirements are to be met in part by the new nuclear powerplant at Paks, by electric energy imports, and by expansion of brown coal output.

The expansion of brown coal output is planned to meet the fuel requirements of thermal powerplants. However, the putting into operation of the Bicske thermal powerplant that is to be supplied by the new mining operation at Many is to be delayed until the end of the 1980's. This delay is attributed to the reduced growth in energy needs because of the slowing down of economic growth.

During the fifth 5-year plan, 32% of industrial investment was for projects in the energy sector (production of coal, hydrocarbons, and electric energy, processing of oil and gas, development of the distribution network, etc.). During the sixth 5-year plan, there is to be continued heavy investment to exploit the extensive, but generally low-quality coal deposits, to complete the nuclear power program, and to acquire technology and equipment for deep drilling and secondary recovery techniques for the limited oil and natural gas deposits.

During the sixth 5-year plan, total energy use is to increase by 2% annually in comparison with the 3.3% rate of the last plan period, and electric energy consumption is to increase by 3.5% annually instead of the previous 4.9%. The projected growth in energy consumption is to be 0.6% to 0.7% for each 1% growth in the gross national product. The energy savings program for the sixth 5-year plan calls for substituting imported crude oil and petroleum products with domestic coal and natural gas. Owing to its participation in the construction of the Khmelnitskiy nuclear powerplant in the Soviet Union, Hungary is to begin receiving imports of electricity from this cooperative venture.

Along with imports and fuel substitution, the energy savings program is to include modernizing technological processess in metallurgy to save coke, increasing motor vehicle inspections, individually metering dwelling units, improving building insulation, making more energy efficient appliances, etc. In addition, ways are being sought to make greater use of nonconventional energy sources such as solar, geothermal waters, waste heat, and forest deadfall.

The total energy balance for 1979 and 1980 is shown in table 4.

Table 4.—Hungary: Primary energy balance for 1979 and 1980

(Million tons of standard coal equivalent[1])

Year	Total primary energy	Coal (lignite, anthracite, bituminous), coke, and briquets	Crude oil and petroleum products	Natural and associated gas	Fuelwood	Hydroelectric and other power
1980:						
Production	26.4	14.5	3.0	8.2	0.7	--
Exports	3.1	.05	3.0	.01	--	--
Imports	23.8	2.9	14.5	5.4	--	1.0
Apparent consumption	47.1	17.3	14.5	13.6	.7	1.0
1979:						
Production	26.8	14.4	3.0	8.7	.7	--
Exports	2.6	.05	2.5	.01	--	--
Imports	24.6	2.8	17.5	3.6	--	.7
Apparent consumption	48.8	17.1	18.0	12.3	.7	.7

[1]One ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are hard coal, 1.0; lignite and brown coal, 0.5; briquets 0.67; coke, 0.9; crude oil, 1.47; refinery products, 1.53; natural gas, 1.33 (per thousand cubic meters); manufactured gas, 0.6; and hydroelectric power, 0.125 (per thousand kilowatt-hours).

Coal.—The coal mining industry reported overfulfillment of its targets for the 1976-1980 planning period. In the area of geological exploration, there were reported significant discoveries of bituminous and brown coal.

Four new mines are to be developed under the Eocene program; Hungary's large-scale program to reduce foreign energy dependency by developing domestic brown coal reserves. Two mines are to be opened in 1981, 1 year ahead of schedule. These are the Nagyegyhaza Mine, an estimated 55-million-ton brown coal field scheduled to produce approximately 1.7 million tons of coal per year by 1985, and the Markus-Hegy Mine, proclaimed as Hungary's most modern coal mine with an eventual capacity of 8,000 tons per day. The Markus-Hegy Mine, the first to begin production, is expected to produce 300,000 tons of brown coal in 1981 and 800,000 tons in 1982. At the largest new mining site at Many, with an approximate 100-million-ton deposit, the scheduled start of production has been delayed an additional year. Production at Many from the seams closest to the surface is to begin in 1983. At the fourth new mine, the Lencse-Hegy II Mine, a revised plan has been enacted to begin production in 1982 instead of 1985. The Eocene program also calls for the renovation of the Balinka and Dudar Mines.

In addition to development and renovation, attention is being given to the expansion of existing mines. For example, new benches are being brought into production at the Thorez surface mine, Hungary's largest coal mine. It is also planned to establish brown-coal-based coke and briquet manufacturing.

The increasing cost of imported coking coal is said to impose an unbearable burden on domestic metallurgy, which relies on imports for a large percentage of its needs. The Lias program calls for the exploration of new liassic bituminous coal deposits. It is designed to increase domestic coking coal production in the Mecsek area, containing Hungary's only bituminous coal reserves. Coking coal production is planned to increase to 670,000 tons per year by 1986 and to 900,000 tons per year by 1990. The Lias program is closely connected to supplying coking coal for the planned expansion of the Danube metallurgical works. Even with increased deliveries from the Lias program, the Danube works will require large amounts of imported coking coal.

In 1980, personnel in coal mining decreased to 78,000 workers. A labor problem exists because it is difficult to attract young people to this profession, and there is a high rate of attrition for workers. Absenteeism is also a problem at mines. This has forced coal miners to put in extra days to achieve targeted production.[14]

In 1981, the Coal Mining Trust is to be abolished and the enterprises are to be declared independent. The Trust's functions are to be assumed by the Coal Mining Coordination Center and the Coal Mining Management Council. The Coordination Center, among its other duties, is to assist in technical development and standardization. Enterprises operating under the Coordination Center include the Dorog, Mecsek, Borsod, Matraalja, Veszprem, Oroszlany, Tatabanya, and Nograd coal mining enterprises, and the Mining Supply enterprise.

The other new organization, the Management Council, is to assume some of the

managerial responsibilities of the Trust. The Management Council, which is to be headed by a chairman, is to contain the directors of the coal mining enterprises and is to include the chairman of the Coordination Center, who is to have advisory rights. The Management Council is to be given the responsibility for coordinating at the sector level all long-term, medium-term, and annual plans for the coal mining industry.

Natural Gas.—Efforts are to be made during the sixth 5-year plan to maintain natural gas production at the 1980 level. As of January 1, 1980, natural gas reserves were estimated at 115 billion cubic meters. Although Hungary's position regarding natural gas production is more favorable than it is for crude oil, the country is still dependent on imports. The Soviet Union is the major supplier with deliveries in 1980 of approximately 3.8 billion cubic meters. Hungary also receives 200 million cubic meters of natural gas annually from Romania under the provisions of a long-term contract that expires in 1983.

Maintaining current production levels will become more difficult as present reserves become depleted. In 1981, production of natural gas is projected to decline at Hungary's largest producing Algyo Field. Increased efforts are being made to use natural gas reserves rich in inert gas of which there is a substantial volume. Starting in 1983, production is to begin of an additional 500 million cubic meters of natural gas with high inert gas content for use in the Tisza thermal powerplant.

In order to accommodate imports and to avert shortages during peak usage periods, more storage capacity must be made available. Underground gas storage facilities at Hajduszoboszlo and Kardoskut were scheduled to begin operation by 1980. There is also a need for increased domestic gas transport capacity.

Regarding international gas transport, plans are to increase the capacity of the Brotherhood pipeline to enable the U.S.S.R. to ship gas directly to Yugoslavia. At present, Hungary delivers gas from its own fields to Yugoslavia and is then compensated for these deliveries by the U.S.S.R.

Nonconventional Energy.—Nonconventional energy production is being introduced. Hungary has abundant geothermal waters that are considered an energy source for auxiliary usages. In 1979, nonelectric uses for geothermal waters were estimated at 300 thermal megawatts for space heating and 370 thermal megawatts in agriculture. In Szeged, 10,000 apartments are heated by thermal water that is then pumped back into the wells to prevent exhaustion of the deposits.

Wind power is also being used. Hungary's largest wind-powered well was put into operation at the Mezofalva agricultural complex. It yields 40 liters of water per minute and has a reserve to hold water for 4 to 5 windless days. The Mezofalva complex has set up a plant to manufacture this wind-powered equipment. Solar power is not planned to play a significant role until better technical and economic solutions are developed.

Nuclear Power.—Nuclear power is stated to be a necessity owing to a lack of other alternatives. Also, domestic uranium ore deposits present favorable conditions for nuclear energy development. The first nuclear powerplant at Paks is to be equipped with four 440-megawatt reactors. The first 440-megawatt reactor is scheduled to go into operation in 1981, and the three others are to be installed by the mid-1980's. Equipment for the Paks nuclear powerplant is being supplied primarily by the Soviet Union along with other CMEA countries. Following the installation of the four 440-megawatt reactors, plans are to install several 1,000-megawatt reactors.

Claims are being made that the safety measures included in the design of the Paks nuclear powerplant will preclude any accidents. Also, Hungary has developed a process for waste disposal that it states can greatly reduce transport and storage costs.

In addition to developing domestic nuclear power, Hungary is participating in the construction of the Khmelnitskiy nuclear powerplant in the Soviet Union. The Khmelnitskiy powerplant is to begin supplying Hungary with electricity by the mid-1980's.

Reportedly, Hungary mines uranium in quantities large enough to serve industrial purposes. Uranium ore mined in the Mecsek region is described as primarily pitchblende and uranite with other secondary uranium ores. Regarding future production, in an article published in Hungary's national daily newspaper "Nepszabadsag," on January 18, 1981, the State Secretary for the Ministry of Industry, Laszlo Kapolyi, stated that uranium ore production cannot

be increased.[15]

Petroleum.—During 1980, crude oil production increased slightly, and efforts are to be made during the sixth 5-year plan to maintain crude oil production at its 1980 level. Intensive exploration is needed to accomplish this as current reserves are becoming depleted. In 1981, there is to be an expected decrease in crude oil output at the Algyo Fields of approximately 64,000 tons.[16] Pressure in the wells is dropping, and there is an increasing amount of water. The Algyo Fields currently account for approximately 75% of domestic crude oil production and in 1985 are to still account for 65%. At present, 1,600 persons are employed in the Algyo Fields in the production of oil and natural gas. In an effort to utilize all hydrocarbon resources, in 1980 detailed exploration was conducted to determine future use of oil shale deposits discovered in Transdanubia in 1972.

In 1980, construction was completed of the first phase of the Tisza oil refinery with a capacity of three million tons per year. During the sixth 5-year plan, construction is planned of a 1-million-ton-per-year catalytic cracking plant at the Szazhalombatta refinery. Production is scheduled to begin in 1984. A $50 million contract for this project has been awarded to France's Procofrance S.A. Construction of this plant is part of a strategy to replace fuel oil with coal and to instead produce the lighter petroleum products.

In 1980, a 40.4-mile long, 6-inch diameter crude line from Kiskunhalas to Baja was scheduled for completion. Oil transport and storage capacity are considered sufficient, and during the sixth 5-year plan, no additional oil pipeline construction is envisaged. Oil storage capacity, which increased from a 25-day supply in 1975 to a 28-day supply in 1980, is now considered adequate to satisfy seasonal demand.

Approximately 20% of Hungary's crude oil requirements are met by domestic production. The Soviet Union is Hungary's chief oil supplier and in 1980 was scheduled to deliver 7.5 million tons of crude oil. In negotiations with the Soviet Union, Hungary's aim is to maintain and, if possible, to expand imports. Imports of oil from the market-economy countries are to be held to the necessary minimum.

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[1]Foreign mineral specialist, Branch of Foreign Data.

[2]The commercial and noncommercial rates of exchange for the Hungarian forint (Ft) have been undergoing periodic reevaluations. These rates have been adjusted monthly although more frequent changes are envisaged. Hungary states its future goal is to have a unified exchange rate. The exchange rate for the forint as of Aug. 28, 1981, quoted by the National Bank of Hungary was, noncommercial—Ft32.63=US$1 (buying), Ft32.70=US$1 (selling);. commercial—Ft35.57=US$1 (buying) Ft35.64=US$1 (selling).

[3]Hungarian Trade Union News, Budapest. No. 7, 1980, p. 10.

Statistical Pocket Book of Hungary, Budapest. 1981, p. 179.

[4]U.S. Department of Commerce, International Trade Administration. U.S.-Hungarian Trade Trends, 1980. March 1981, p. 16.

The Journal of Commerce, New York. Jan. 22, 1981, p. 6.

[5]CMEA - Council for Mutual Economic Assistance. Its current members include Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia has associate status with limited participation, but is normally not included for statistical purposes.

[6]Külkereskedelmi statisztikai évkönyv, 1980 (Foreign Trade Statistical Yearbook), Budapest, 1981, p.125.

[7]Mining Annual Review, London. June 1981, p. 600.

[8]Banyaszat (Mining), Budapest. No. 9, September 1980, pp. 606-609.

[9]Kohaszat (Metallurgy), Budapest. Nos. 3-4, March-April 1980, pp. 100-103.

[10]Pages 124-126 of work cited in footnote 9.

[11]Work cited in footnote 8.

[12]Pages 119-123 of work cited in footnote 9.

[13]Magyar Mezogazdasag (Hungarian Agriculture), Budapest. No. 13, Mar. 26, 1980, p. 4.

Magyar Kemikusok Lapja (Hungarian Chemists' Journal). No. 1, 1980, pp. 1-9.

[14]Mining Journal, London. Jan. 16, 1981, p. 40.

Glueckauf, Essen. No. 1, 1981, p. 30.

[15]Nepszabadsag, Budapest. Jan. 18, 1981, p. 5.

[16]Nepszabadsag, Budapest. Mar. 29, 1981, p. 5.

The Mineral Industry of Iceland

By Joseph B. Huvos[1]

Although Iceland has no significant mineral resources, there is an abundance of hydroelectric and geothermal power that supports energy-intensive industries for the processing of imported raw materials. The mineral and mineral-related industries' chief contributions to the national economy continued to be inexpensive hydroelectric power, geothermal energy, aluminum, ferroalloys, and some nonmetallic minerals.

In 1980, the Icelandic economy had both a low rate of growth (1%) and a high rate of inflation (48%); consequently, on January 1, 1981, a new krona, the unit of currency, was introduced, its value being equal to 100 old kronas. The gross national product was $2.7 billion.[2] Average unemployment for the year was only 0.4%.

Noteworthy events included the commissioning of Icelandic Alloys Ltd.'s second ferrosilicon furnace; a shortage of electric power due to a lack of rain and snow; an eruption of a volcano, causing disruption in diatomite production; and completion of feasibility studies for a third ferroalloy furnace, a magnesium plant, and an oil refinery.

PRODUCTION

Production of mineral commodities for the years 1976-80 is shown in table 1.

Table 1.—Iceland: Production of mineral commodities[1]

Commodity and unit of measure	1976	1977	1978	1979	1980[p]
Aluminum metal, primary metric tons	65,300	74,245	73,800	72,145	73,111
Cement, hydraulic thousand metric tons	145	139	134	127	122
Diatomite metric tons	[2]22,699	[2]20,985	20,020	21,288	18,150
Iron and steel ferroalloys: Ferrosilicon do.	--	--	--	15,000	25,309
Nitrogen: N content of ammonia[e] do.	8,000	6,000	7,000	7,000	7,000
Pumice do.	[2]1,529	[2]7,586	8,497	24,462	36,000
Salt do.	--	--	--	--	53
Sand and gravel:					
Calcareous thousand cubic meters	105	111	107	180	109
Basaltic cubic meters	7,200	NA	10,800	6,200	4,900
Other thousand metric tons	[r]500	430	410	NA	NA
Stone:					
Crushed and broken do.	28	30	28	25	24
Scoria do.	93	100	85	110	[e]95
Silica dust metric tons	NA	NA	NA	4,400	4,400

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Sept. 3, 1981.
[2]Data represents exports.

TRADE

In 1978 and 1979 there was no significant change in Iceland's modest foreign mineral trade. Iceland's mineral trade in 1978 and 1979 is shown in tables 2 and 3.

Table 2.—Iceland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum metal including alloys, unwrought	77,349	76,225	United Kingdom 20,219; West Germany 18,892; Switzerland 18,679.
Iron and steel metal:			
Scrap	8,842	3,343	Denmark 2,123.
Ferrosilicon	--	12,539	United Kingdom 6,008; Poland 3,320; West Germany 2,409.
Other nonferrous metals including alloys, scrap	407	365	Netherlands 211.
NONMETALS			
Diatomite	20,020	21,288	West Germany 5,762; France 3,238; United Kingdom 2,148.
Pumice	8,497	24,462	Denmark 20,667.
Other: Crude, natural	45	--	

Table 3.—Iceland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina	141,907	142,465	NA	Australia 142,461.
Metal including alloys:				
Unwrought	77	133	--	United Kingdom 126.
Semimanufactures	826	1,039	16	Norway 281; West Germany 220; Switzerland 144.
Chromium oxides and hydroxides	3	NA	NA	NA.
Copper metal including alloys, semimanufactures	156	160	NA	West Germany 58.
Iron and steel:				
Ore and concentrate	--	8,700	--	All from Norway.
Metal:				
Pig iron, ferroalloys, powder, shot	134	--		
Steel, primary forms	417	542	--	Norway 499.
Semimanufactures:				
Bars, rods, angles, shapes, sections	20,665	21,031	NA	Norway 12,024; United Kingdom 1,922; West Germany 1,676.
Universals, plates, sheets	14,446	13,348	NA	West Germany 3,865; Belgium-Luxembourg 2,869; Sweden 1,829.
Hoop and strip	320	337	--	NA.
Rails and accessories	17	--		
Wire	282	196	NA	NA.
Tubes, pipes, fittings	7,453	8,260	--	West Germany 3,061; Netherlands 1,290; United Kingdom 1,245.
Lead:				
Oxides	25	NA	NA	NA.
Metal including alloys:				
Unwrought	40	163	--	Denmark 160.
Semimanufactures	1	45	--	Denmark 5.
Mercury 76-pound flasks	6	NA	NA	NA.
Nickel metal including alloys, all forms	2	--		
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$125	$163	NA	NA.
Silver metal including alloys, unwrought and partly wrought do	$318	$263	NA	West Germany $153.
Tin metal including alloys, unwrought and semimanufactures	8	--		
Titanium oxides	532	NA	NA	NA.
Tungsten metal including alloys, all forms kilograms	100	--		
Zinc:				
Oxides	14	NA	NA	NA.

See footnotes at end of table.

Table 3.—Iceland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Metal including alloys:				
Blue powder	5	--		
Unwrought	143	--		
Semimanufactures	10	--		
Other:				
Ores and concentrates	--	2	NA	NA.
Oxides, hydroxides, peroxides	5	967	300	United Kingdom 297; Norway 262; West Germany 84.
Base metals including alloys, all forms	1	--		
NONMETALS				
Abrasives, n.e.s.:				
Natural	28	NA	NA	NA.
Grinding and polishing wheels and stones	27	17	NA	NA.
Asbestos, crude	11	NA	NA	NA.
Barite and witherite	21	NA	NA	NA.
Boron materials	1	NA	NA	NA.
Cement	15,687	19,876	--	All from Denmark.
Chalk	288	NA	NA	NA.
Clays and clay products:				
Crude clays	298	[1]392	NA	NA.
Products:				
Refractory including nonclay brick	1,755	1,643	--	United Kingdom 544; Denmark 424; France 400.
Nonrefractory	1,047	931	--	West Germany 330; Italy 212; Sweden 197.
Cryolite and chiolite	500	[2]25,926	NA	Norway 25,375.
Diamond, all grades value	[r]$1,279	--		
Diatomite and other infusorial earth	34	NA	NA	NA.
Fertilizer materials:				
Crude	10	--		
Manufactured:				
Phosphatic	--	1,894	--	All from Denmark.
Potassic	5,801	5,673	--	Belgium-Luxembourg 3,500; East Germany 2,172.
Other including mixed	30,239	35,410	--	Norway 21,023; Netherlands 7,653; Tunisia 3,354.
Ammonia	3,015	NA	NA	NA.
Gypsum and plasters	7,481	NA	NA	NA.
Lime	942	890	--	United Kingdom 562.
Mica, all forms	14	NA	NA	NA.
Pigments, mineral including processed iron oxides	42	NA	NA	NA.
Precious and semiprecious stones except diamond value	[r]$1,618	--		
Salt and brine	56,997	49,242	--	Spain 25,116; Tunisia 21,053.
Sodium and potassium compounds, n.e.s	546	NA	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	54	NA	NA	NA.
Worked	86	69	NA	Italy 60.
Dolomite, chiefly refractory grade	76	NA	NA	NA.
Gravel and crushed rock	417	NA	NA	NA.
Limestone, except dimension	60	NA	NA	NA.
Quartz and quartzite	73	NA	NA	NA.
Sand, excluding metal-bearing	271	NA	NA	NA.
Total	1,037	4,252		
Sulfur, all forms	732	NA	NA	NA.
Talc, steatite, soapstone, pyrophyllite	105	NA	NA	NA.
Other:				
Crude	7	3,242	NA	Norway 3,056.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	18	NA	NA	NA.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals	457	1,074	NA	West Germany 570; Austria 227.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1	--		
Coal and briquets:				
Anthracite	156	9,833	--	Poland 8,988; United Kingdom 845.
Bituminous coal, lignite, peat including briquets	69	37	--	United Kingdom 12.
Coke and semicoke	50	11,904	--	Norway 7,272; United Kingdom 4,606.

See footnotes at end of table.

Table 3.—Iceland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	834	834	--	U.S.S.R. 642; Portugal 157; Netherlands 22.
Kerosine ---do---	682	498	--	Netherlands 256; Belgium-Luxembourg 92; Norway 52; Nigeria 50.
Distillate fuel oil ---do---	2,252	2,306	--	U.S.S.R. 1,266; Portugal 346; Netherlands 284.
Residual fuel oil ---do---	764	1,075	--	U.S.S.R. 863; Netherlands 136; Belgium-Luxembourg 62.
Lubricants ---do---	46	62	NA	United Kingdom 43; Belgium-Luxembourg 12.
Mineral jelly and wax ---do---	4	5	NA	United Kingdom 2; West Germany 2.
Other:				
Liquefied petroleum gas ---do---	10	11	--	Netherlands 10.
Pitch coke ---do---	28	1	--	Mainly from West Germany.
Bitumen, petroleum coke ---do---	NA	68	--	United Kingdom 36; Belgium-Luxembourg 16; Norway 15.
Unspecified ---do---	2	4	NA	NA.
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals	266	NA	NA	NA.

[r]Revised. NA Not available.
[1]May include magnesite, dolomite, graphite.
[2]May include quartz, mica, feldspar, fluorspar.

COMMODITY REVIEW

METALS

Aluminum.—According to an allegation by the Icelandic Government, Swiss Aluminium Ltd. (Alusuisse) has over a period of 7 years withheld profits amounting to $60 million from its subsidiary, Icelandic Aluminum Co. Ltd. (ISAL), which would otherwise have been subject to a tax by the Icelandic authorities. This was done, the statement alleged, by Alusuisse's selling alumina to the ISAL smelter from the Gove deposit in Australia (which is owned by Alusuisse) at excessive prices. Alusuisse claimed the allegations were the result of a misunderstanding, and discussions were initiated to settle the differences. Another point of difference between the two parties was the price of electricity supplied on contract by Icelandic authorities to the aluminum smelter.

Iceland's only aluminum smelter, located at Straumsvik, south of Reykjavik, was operated by ISAL, a wholly owned subsidiary of Alusuisse. The 75,000-ton plant was supplied with power by the National Power Co. of Iceland, jointly owned by the Government and the city of Reykjavik. Production of aluminum increased slightly, from 72,000 tons in 1979 to 73,000 tons in 1980.

Ferroalloys.—In 1980, Icelandic Alloys Ltd. continued production at its first ferrosilicon furnace, completed the previous year in Grundartangi, north of Reykjavik. Although there were temporary shortages of electric power and cooling water, 25,309 tons of ferrosilicon was produced.

A contract was concluded to sell the plant's flue dust to the State cement plant to be used as an additive in cement. In 1980, 4,400 tons of silica dust pellets was sold.

A feasibility study was completed for a third ferrosilicon furnace at Grundartangi. However, in view of the power situation, the company's board of directors decided to postpone the project for at least 1 year. Icelandic Alloys Ltd. is jointly owned by the Icelandic Government (55%) and Elkem Spigerverket AS of Norway (45%). At present, the equipment consists of two 30-megawatt semiopen rotary Elkem furnaces.

Magnesium.—It was reported that Iceland's Ministry of Energy and Industry was completing a feasibility study to build a magnesium smelter based on seawater and domestic hydropower. Such an industry would be completely independent of foreign raw materials.

NONMETALS

Diatomite.—An alert was ordered at the Lake Myvatn diatomite plant at Lake My-

vatn when, for the third time in 1980, lava erupted in the area, near Krafla, not far from the plant. The diatomite plant, the only one in the world to be operated by geothermal steam, was not damaged by the eruption. Diatomite is recovered from Lake Myvatn. The plant is a joint enterprise of the Icelandic Government and of Johns-Manville Corp. of the United States.

Pumice.—In 1980, Jardefnaidnadur, a south Iceland enterprise, shipped about 36,000 tons of pumice to Denmark. In 1981, exports are to be increased substantially. Pumice, used mainly as an additive for lightweight concrete, is recovered on the slopes of the volcano Mount Hekla, where it has accumulated by repeated eruptions of the volcano. Production during the warm season from March to fall is stored in Thorlákshöfn, a small fishing port southeast of Reykjavik.

MINERAL FUELS

Hydroelectric Power.—In September the Minister of Energy and Industry inaugurated a newly finished 160-kilometer-long power supply line connecting Arnafjördur (northwest-Iceland) to Hrutarfjördur (southeast of Arnafjördur), and to the central area of southern Iceland where the large hydropower plants are located. This will eliminate use of diesel powerplants in the Arnafjördur region, where geothermal heat is scarce.

During 1980, there was a 36% shortage of electric power due to a lack of precipitation. Power-intensive industries such as aluminum, ferroalloys, and diatomite had to curtail production. However by yearend, it was reported that the water level in Lake Thorisvatn, the main reservoir of the National Power Co. in the south, was nearing normal.

Petroleum.—A study was sponsored by Iceland's Fish Industries Fund on the feasibility of an oil refinery in Iceland. The refinery could have a throughput of up to 100,000 tons per year. Conclusions of the study were not released.

Iceland has no oil refinery and imports petroleum products, mostly from the Soviet Union.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from the old Icelandic krona (Ikr) to U.S. dollars at the rate of Ikr480 = US$1.00.

The Mineral Industry of India

By Gordon L. Kinney[1] and Francis E. Shafer[2]

The Indian economy had a rather good year overall despite continuing problems in the energy and transportation sectors. Gross national product (GNP) recorded an 8% increase during fiscal year 1980-81[3] (at constant 1970 prices). GNP at current prices was $165 billion[4] compared with $135 billion in fiscal year 1979-80. The improvement was mainly because the critically important Indian agricultural sector made a strong recovery in 1980-81 from the effects of one of the century's worst monsoons the previous year.

Industrial production, which declined 1.4% in fiscal year 1979-80, increased 3% during the year. Most of the growth came after July 1980 following modest improvements in the coal, electric power, and transportation sectors. The planned industrial increase of 8% set in the sixth 5-year plan was not met. Major industries registering production declines during fiscal year 1980-81 included aluminum, cement, nitrogenous fertilizer, steel, and zinc.[5]

Although India was an important producer and consumer of many mineral products, its per capita consumption, because of its large population, was one of the lowest of any major nation. Per capita steel consumption, for instance, was about 14 kilograms compared with the world average of around 165 kilograms per year. The Indian per capita energy consumption was 200 kilograms of coal equivalent compared with the world average of 2,050 kilograms and the U.S. usage of nearly 12,000 kilograms per year. Value of mineral production has increased at a rate of 5% per year since 1970.

After a 5-year period of stagnation at around 100 million tons, coal production rose encouragingly and in turn stimulated thermal power output. The monsoon also helped the hydroelectric output after the drought conditions had curtailed that sector's output in fiscal year 1979-80. Other industries that registered improved performance were electronics, automotive equipment, machine tools, tractors, paper, cotton textiles, and railroad rolling stock. Most industries, however, continue to be afflicted by labor problems, power shortages, and transportation constraints, as well as difficulties associated with obsolete plants and equipment. The poor performance of the Indian railroad system was a serious impediment to all industries.

The labor situation improved a great deal during 1980 but was still a major factor in the industrial economy. Employee-days lost as a result of labor disputes declined from about 44 million in 1979 to 13 million in 1980. However, labor unrest—slowdowns, work-to-rule, and similar actions—continued to be a major hindrance to industrial production, particularly affecting key sectors such as railways, coal, power, petroleum, and banking. With no relief from inflation in sight in 1981, worker demands for higher wages will continue.

Much of India's heavy industry was owned by the Central Government. Performance of these Central Government public sector corporations continued to deteriorate, with losses almost doubling to $93 million in fiscal year 1979-80 as against $50 million the previous year. Overall performance statistics were not available for fiscal year 1980-81. However, the Indian press indicated that the Steel Authority of India Ltd. (SAIL) alone would suffer its heaviest ever loss in 1980-81, possibly more than the whole public sector loss in 1979-80.[6]

Power generation increased about 6% in 1980-81 as against a 2% increase the previous year, but serious power shortages continued in several States. The overall national supply-demand gap rose 2% to about 14% in 1980-81. Rajasthan and Tamil Nadu face the most serious shortages, and marginal power cuts continued in Maharashtra,

Gujarat, Karnataka, Madhya Pradesh, Haryana, and Punjab. There was recent improvement in power supplies to heavily industrial West Bengal and Bihar, but these States continued to operate under chronic shortages. A reliable power supply will be a key factor in the improving performance of the coal and steel sectors.

Thermal power capacity utilization, which declined from 56% in fiscal year 1976-77 to 45% in 1979-80, has reportedly improved to 48% in 1980-81. The India Government planned to invest $90 billion in the electric power industry during the next 15 years. Generating capacity reportedly was to be increased from the present 30,000 megawatts to 100,000 megawatts by 1995. It remains to be seen if such an ambitious construction program can be accomplished, even with concessional loans from foreign countries and international financial organizations.

PRODUCTION

India was a major world producer of a number of important minerals. Of the market economy countries, it was the principal producer of sheet mica; second only to the United States in ammonia for nitrogen fertilizer; third in garnet, kyanite, and the rare earths; and fourth in barite and zirconium. In addition, India was in the top nine producers of several other minerals including iron ore, chromite, manganese, cement, and magnesite.

The output of chromite and iron ore, key inputs into India's steel industry as well as major export commodities registered only marginal gains in 1980. Barite production declined significantly, and manganese ore dropped owing largely to a fall in export demand. Steel production, with strong support from the mini-steel plants, just managed to exceed the 1979 output. Despite chronic shortages of power, aluminum manufactures managed a slight increase in overall production with most of the gain coming in the fourth quarter of 1980. Production of the other nonferrous industries was mixed. Lead and blister copper made sound increases. Zinc suffered severely from the power constraints and labor problems that held capacity utilization to about 50%.

The total value of mineral production during 1979 was $2.12 billion and was estimated at $2.68 billion, an alltime high, in 1980. The minehead value of nonfuel mineral production in 1980 was $450 million, slightly lower than the $463 million recorded in 1979.

Mineral output in India can be quite seasonal owing to the monsoon condition's effect on manual mining operations and on the transportation system. In the good weather months of February and March 1980, the combined value of mineral production was $448 million. Solid fuels accounted for 69%; petroleum and natural gas, 15%; metallic minerals, 10%; and nonmetallic minerals, 6% of the total value.

Of India's 30 States and territories, Bihar occupied the leading position with 34% of total value, followed by Madhya Pradesh 17%, West Bengal 13%, Gujarat 6%, Andhra Pradesh 4.8%, and Orissa 4.2%. Value of petroleum from the offshore Bombay High has been climbing steadily since 1977 to a solid fourth place after West Bengal with 9.6% of the total January and February value. Continuing development of the offshore area for oil and natural gas will probably put Bombay High (BH) first in economic importance within 5 years.

Table 1.—India: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite, gross weight ----- thousand tons--	[r]1,449	[r]1,519	1,663	1,934	1,740
Alumina, gross weight ----------do----	442	[r]387	480	493	[e]500
Metal, primary----------	209,549	179,000	213,729	211,759	184,838
Antimony metal, regulus----------	404	186	--	--	--
Cadmium metal ----------	34	44	113	166	89
Chromium: Chromite, gross weight----------	[r]402,111	352,500	266,293	309,142	319,538

See footnotes at end of table.

Table 1.—India: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS —Continued					
Copper:					
Mine output, metal content	[r]29,280	31,200	26,040	26,520	[e]22,000
Metal:					
Smelter	[r]24,696	[r]23,489	19,481	21,455	28,489
Refined	20,900	[r]21,059	17,682	14,707	17,021
Gold metal, smelter troy ounces	100,696	96,902	89,186	84,749	78,834
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	43,868	42,598	38,838	39,534	40,670
Iron content do	27,461	26,666	24,313	24,748	25,459
Metal:					
Pig iron do	9,776	9,796	9,432	8,767	8,459
Ferroalloys:					
Ferrochrome	[r]17,005	18,068	21,545	22,168	16,012
Ferromanganese	[r]175,760	193,908	219,993	188,683	162,650
Ferrosilicon	[r]53,947	44,675	52,275	51,169	42,606
Ferrosilicochrome	[r]5,100	4,155	3,892	3,780	4,037
Other	303	10,833	3,634	2,844	535
Crude steel:					
Steel ingots thousand tons	[r]9,403	9,852	9,917	9,931	9,356
Steel castings do	61	66	[e]70	65	[e]65
Total do	9,464	9,918	[e]9,987	9,996	9,421
Semimanufactures:[3]					
Angles, shapes, sections do	908	1,012	1,040	[e]1,000	[e]1,000
Bars and rods do	2,534	2,312	2,300	[e]2,200	[e]2,200
Plates and sheets:					
Uncoated do	970	1,019	1,062	[e]1,100	[e]1,000
Galvanized do	178	192	194	[e]200	[e]200
Tinplate do	114	110	90	[e]100	[e]100
Hoop, strip, strapping, skelp do	1,092	1,166	1,153	[e]1,100	[e]1,100
Rails and accessories do	376	497	452	400	[e]350
Wire do	321	326	351	234	[e]240
Special steels, not further specified do	322	352	422	518	[e]550
Total do	6,815	6,986	7,064	6,852	[e]6,740
Lead:					
Mine output, metal content	[r]11,520	[r]12,720	12,840	15,960	14,846
Metal, refined:					
Primary	5,435	7,588	10,059	9,820	14,846
Secondary	9,600	12,400	10,900	10,800	10,732
Total	15,035	19,988	20,959	20,620	25,578
Magnesium	30	107	23	28	13
Manganese ore and concentrate, gross weight thousand tons	1,835	1,865	1,619	1,755	1,645
Rare-earth metals: Monazite concentrate, gross weight[e]	3,000	[r]2,734	3,272	2,631	[e]4,210
Selenium kilograms	723	4,078	5,151	4,596	[e]3,800
Silver, mine and smelter output thousand troy ounces	102	425	388	370	366
Titanium concentrates, gross weight:[e]					
Ilmenite	82,000	[3]137,350	[3]161,536	[3]146,843	[e]167,900
Rutile	3,600	[3]5,491	[3]5,660	[3]4,940	[e]5,360
Tungsten, mine output, metal content	23	[r]22	21	20	22
Zinc:					
Mine output, metal content	27,408	32,500	39,768	39,000	[e]27,000
Metal:					
Primary	26,785	35,997	59,354	63,326	43,627
Secondary	NA	NA	NA	NA	234
Total	26,785	35,997	59,354	63,326	43,861
Zirconium concentrate: Zircon, gross weight[e]	10,300	10,677	11,167	9,056	[e]10,845
NONMETALS					
Abrasives, natural, n.e.s.:					
Corundum, natural	[r]526	1,306	1,082	892	1,454
Garnet	2,075	1,825	2,467	6,806	3,742
Jasper	1,593	1,450	2,631	3,325	[e]4,000
Asbestos	24,119	22,177	24,623	37,816	31,253
Barite	235,068	330,989	388,582	387,815	345,948
Bromine, elemental	440	510	460	300	334
Cement, hydraulic thousand tons	18,640	19,060	19,560	18,264	17,700

See footnotes at end of table.

Table 1.—India: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Chalk	r61,349	61,414	74,813	80,273	87,142
Clays:					
Ball clay	r32,569	48,369	96,552	126,802	125,457
Diaspore	10,090	7,900	4,909	6,317	5,504
Fire clay	666,000	726,000	725,000	789,291	656,279
Kaolin:					
Direct salable, crude thousand tons	335	349	304	361	349
Processed do.	103	96	114	110	97
Total do.	438	445	418	471	446
Other do.	242	129	71	68	80
Diamond:					
Gem[e] thousand carats	17	15	14	13	12
Industrial[e] do.	3	3	2	2	2
Total do.	20	18	16	15	14
Feldspar	55,307	54,710	51,675	50,157	58,610
Fluorspar:					
Concentrates:					
Acid-grade	9,709	9,069	9,678	10,530	12,349
Metallurgical-grade	4,271	6,140	4,349	6,562	8,898
Total	13,980	15,209	14,027	17,092	21,247
Other fluorspar materials (grade)	3,643	3,586	3,519	4,081	e4,100
Gem stones excluding diamond:					
Agate (including chalcedony pebble)	3,128	1,768	2,268	1,687	1,378
Emerald, crude carats	825	550	35,085	3,760	6,600
Garnet kilogr, ms	3,673	5,529	4,912	4,303	3,726
Graphite	38,273	48,455	63,784	50,930	48,795
Gypsum thousand tons	727	778	884	861	856
Kyanite and related materials:					
Andalusite	NA	387	225	--	--
Kyanite	48,779	42,123	30,897	39,016	46,522
Sillimanite	14,859	15,023	13,471	15,736	12,987
Lime	182,000	e182,000	e200,000	e408,000	e400,000
Magnesite	329,698	402,007	414,166	384,665	370,573
Mica:					
Exports:					
Block	r890	1,099	1,455	1,400	e1,400
Film and disk	146	126	123	130	e150
Splittings	3,534	3,445	4,186	4,200	e4,300
Scrap	8,055	9,958	e9,900	12,000	e12,200
Powder	9,238	7,505	e8,200	8,400	e8,500
Manufactured	301	470	e400	430	e450
Total	22,164	22,603	24,264	26,560	e27,000
Domestic use (all forms)[e]	11,100	r11,200	11,400	11,600	e11,800
Grand total	33,264	33,803	35,664	38,160	e38,800
Nitrogen: N content of ammonia thousand tons	1,910	2,037	2,220	2,256	2,024
Phosphate rock (including apatite)	644,058	704,961	759,500	644,684	540,932
Pigments, mineral, natural: Ocher	92,053	75,935	77,450	84,873	86,198
Pyrite, gross weight	47,531	31,085	63,781	73,536	83,806
Salt:					
Rock salt thousand tons	4	4	4	4	5
Other do.	4,596	5,328	6,696	7,032	e7,300
Total do.	4,600	5,332	6,700	7,036	7,305
Sodium carbonate	564,000	567,600	590,000	610,000	600,000
Stone, sand and gravel:[4]					
Calcite	21,567	27,445	27,983	29,501	24,028
Dolomite thousand tons	1,886	2,152	1,969	1,998	1,887
Limestone do.	29,891	30,380	30,915	30,586	28,215
Quartz and quartzite do.	414	369	390	322	240
Sand:					
Calcareous do.	1,074	898	932	950	772
Other do.	1,756	1,677	1,620	1,600	1,532
Slate	3,843	21,826	14,319	13,938	11,406

See footnotes at end of table.

Table 1.—India: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sulfur:					
Content of pyrite	19,222	[e]14,080	25,500	29,400	33,522
Byproduct:					
From metallurgical plants[e]	111,000	117,000	115,000	115,000	115,000
From oil refineries	7,000	7,000	7,000	7,000	5,000
Total	137,222	138,080	147,500	151,400	153,522
Talc and related materials:					
Pyrophyllite	34,080	34,619	38,883	31,865	35,924
Steatite (soapstone)	220,000	247,000	298,000	330,000	310,188
Vermiculite	3,435	2,878	1,886	3,063	3,428
Wollastonite	4,541	3,330	1,928	3,729	5,788
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	59,000	59,000	55,000	54,000	NA
Coal:					
Bituminous thousand tons	100,876	[r]100,247	101,973	103,845	109,101
Lignite do.	3,895	3,632	3,613	3,264	4,548
Total do.	104,771	[r]103,879	105,586	107,109	113,649
Coke:					
Coke oven and beehive do.	[e]9,620	10,000	[e]12,100	[e]12,000	[e]12,000
Gashouse do.	48	[e]50	[e]47	[e]100	[e]100
Other, soft[e] do.	3,700	3,700	50	50	50
Total do.	13,368	13,750	[e]12,197	[e]12,150	[e]12,150
Gas, natural:					
Gross million cubic feet	85,108	96,282	97,823	100,000	[e]75,000
Marketable[5] do.	53,466	54,561	61,129	66,957	50,661
Petroleum:					
Crude thousand 42-gallon barrels	64,632	75,787	92,812	93,732	68,655
Refinery products:					
Gasoline do.	11,169	11,645	12,891	12,775	12,393
Kerosine do.	27,980	19,282	19,515	20,440	18,440
Jet fuel do.		8,160	9,424	8,760	
Distillate fuel oil do.	54,518	60,993	64,499	68,620	60,680
Residual fuel oil do.	32,947	34,938	38,601	42,340	41,845
Lubricants do.	2,380	2,828	3,403	2,920	
Other do.	27,991	32,459	34,643	36,135	[e]57,642
Refinery fuel and losses do.	11,067	10,778	13,377	10,950	
Total do.	168,052	181,083	196,353	202,940	[e]191,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 30, 1981.

[2]In addition to the commodities listed, other clays (bentonite, fuller's earth, and common clays), other gem stones (aquamarine, ruby, and spinel), and uranium are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels. In 1975, production of 6,514 tons of uranium ore containing about 3 tons of U_3O_8 was reported from two mines, which was only a part of total national production. Moreover, reported production of stone, sand and gravel are clearly only partial figures, and exclude a number of types of stone; the amounts reported are inadequate to provide sufficient aggregate for production of concrete from domestically produced and consumed cement, nor do they provide for other supplies of aggregate for road metal and other construction uses.

[3]Data are for fiscal year beginning Apr. 1 of that stated.

[4]Partial figures; for details see footnote 2.

[5]Includes reinjected gas.

TRADE

India's external trade continued its recent upward trend by increasing an estimated 25% in 1980. Exports were estimated at $9 billion during fiscal year 1980-81 compared with $8.1 billion in fiscal year 1979-80. The cost of imports rose even faster during the same period, from $11.1 billion to around $15 billion. The trade deficit nearly doubled to $6 billion largely because of increased crude oil prices and increased petroleum product volume. After a period of relative price stability and growing international reserves, India was faced with reemerging chronic inflation and balance of payments problem.

India was a major exporter of several minerals. Valuewise, cut and polished gem stones and jewelry were the top export

category of the mineral-related commodities, earning $808 million in fiscal year 1980-81, an 8% increase over the $730 million (revised) earned in fiscal year 1979-80. About 93% of this value was from diamonds, mostly 1/2 carat or less in size. The source of the diamonds ($500 million worth of imported uncut diamonds) was from Belgium and the United Kingdom. Other major exports were iron ore, $411 million; mica, $28 million; manganese, $18 million; and chromite, $14.5 million.[7]

Petroleum was by far the most important mineral import in 1980 as it has been the last several years. The proportion of petroleum to total imports increased again, going from 35% in fiscal year 1979-80 to 47% in fiscal year 1980-81. According to preliminary trade data, the cost of petroleum imports in fiscal year 1980-81 rose to $6.46 billion from $4.02 billion in the previous year. Other sources put the figure at close to $7.0 billion. The petroleum import bill used up over 70% of the country's export earnings. With the resumption of production in the northeast States coupled with higher offshore production from Bombay High, India's fiscal year 1981-82 petroleum import bill was expected to decline at least $1 billion and possibly more.

Another major mineral-based import was fertilizer. During fiscal year 1980-81, imports recorded a 38% rise to 2.76 million tons valued at $1.16 billion. All types of fertilizer materials were imported by India, which remained totally dependent on imports for its supply of potassium fertilizers. Imports were projected to continue rising during the 1981 to 1985 period.

Table 2.—India: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977[r]	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate value, thousands	[1]$1,616	$11,131	$3	U.S.S.R. $6,872; Brazil $3,280.
Oxides and hydroxides	1,826	NA	NA	NA.
Metal including alloys, unwrought and semimanufactures	16,342	10,208	48	U.S.S.R. 3,224; Libya 1,421; Bangladesh 1,194.
Cadmium metal including alloys, all forms	5	NA	NA	NA.
Chromium ore and concentrate	167,056	59,116	--	Japan 34,715; Switzerland 12,950; North Korea 11,451.
Copper:				
Sulfate	4	NA	NA	NA.
Metal including alloys, unwrought and semimanufactures	462	518	12	Iran 101; Malaysia 50; Tanzania 48.
Iron and steel:				
Ore and concentrate thousand tons	23,190	19,778	--	Japan 14,174; Romania 2,586; Republic of Korea 835.
Metal:				
Scrap	152,330	75,811	--	Japan 59,289; Netherlands 2,398.
Pig iron, cast iron, shot, pellets	853,998	298,743	428	U.S.S.R. 192,783; Japan 31,468; Singapore 25,436.
Ferroalloys:				
Ferrochrome	9,992	9,093	--	Japan 6,973; Netherlands 1,300; Qatar 500.
Ferromanganese	24,343	76,200	--	Japan 14,518; Singapore 12,237; Poland 10,047.
Ferrosilicon	4,249	7,379	--	Japan 7,127; Pakistan 190.
Steel, primary forms	391,626	167,999	12,347	Iran 37,430; Indonesia 31,869; Bangladesh 18,966.
Semimanufactures:				
Bars, rods, angles, shapes, sections	590,118	334,715	6,113	U.S.S.R. 69,539; Kuwait 65,510; Saudi Arabia 45,503.
Universals, plates, sheets	18,609	22,858	99	U.S.S.R. 14,574; Bangladesh 4,025; Thailand 1,041.
Hoop and strip	1,021	1,016	--	Bangladesh 958; Kenya 11; Netherlands 10.
Rails and accessories	90,124	60,275	--	Iran 42,898; Republic of Korea 15,499; Egypt 651.
Wire	5,863	6,813	69	Iran 1,072; China, mainland 904; Sri Lanka 634.
Tubes, pipes, fittings	281,968	258,547	16,960	Bangladesh 51,541; Saudi Arabia 32,922; Iran 15,331.
Castings and forgings, rough	8,639	11,586	6,239	Bangladesh 1,716; Australia 783; Canada 468.

See footnotes at end of table.

Table 2.—India: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[r]	1978	Destinations, 1978	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides and hydroxides	240	NA	NA	NA.
Metal including alloys, all forms value, thousands	(2)	$41	--	Sri Lanka $18; Kuwait $9.
Magnesium and beryllium metals	--	1	--	Mainly to United Kingdom.
Manganese:				
Ore and concentrate	554,375	577,292	--	Japan 394,098; Spain 36,604; Republic of Korea 34,232.
Oxides and hydroxides	653	NA	NA	NA.
Nickel metal including alloys, all forms	11	482	--	Yugoslavia 475; Yemen Arab Republic 4; United Kingdom 3.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	--	$10	--	Kuwait $9; Austria $1.
Selenium, tellurium, arsenic, silicon	41	NA	NA	NA.
Silver metal including alloys, unwrought and partly wrought thousand troy ounces	21,538	18,078	1	United Kingdom 8,190; France 5,061; Switzerland 4,511.
Tin metal including alloys, all forms	61	2	--	Kenya 1; Afghanistan 1.
Titanium ore and concentrate	76,699	96,728	--	Japan 73,000; West Germany 12,352; China, mainland 11,000.
Tungsten metal including alloys, all forms kilograms	500	NA	NA	NA.
Zinc:				
Oxides and hydroxides	875	NA	NA	NA.
Metal including alloys, all forms	20	10	--	United Kingdom 4; Sri Lanka 3; Malaysia 1.
Other:				
Ores and concentrates	--	545	--	Egypt 350.
Oxides and hydroxides	153	[3]3,784	899	United Kingdom 1,050; West Germany 401; Sri Lanka 283.
Base metals including alloys, all forms	443	187	5	United Kingdom 123; Sri Lanka 30; Japan 20.
NONMETALS				
Abrasives, n.e.s.:				
Natural	789	2,279	--	Japan 1,559; Indonesia 175; Netherlands 100.
Dust and powder of precious and semiprecious stones except diamond	556	NA	NA	NA.
Grinding and polishing wheels and stones	2,019	3,373	22	Bangladesh 790; Japan 321; Hong Kong 302.
Asbestos, crude	340	194	34	West Germany 94; Singapore 20; United Kingdom 15.
Barite and witherite	177,188	201,042	16,700	Iraq 76,732; Saudi Arabia 24,543.
Boron materials: Acid	278	NA	NA	NA.
Cement	446,958	48,307	--	Nepal 30,088; Kuwait 18,003.
Chalk	397	NA	NA	NA.
Clays and clay products:				
Crude clays:				
Bentonite	18,588	19,781	NA	Iraq 11,950; Nigeria 2,000; Egypt 1,500.
Other	9,206	NA	NA	NA.
Products:				
Refractory including nonclay brick value, thousands	$3,743	$817	NA	Bangladesh $225; United Arab Emirates $149; Egypt $88.
Nonrefractory do.	$4,757	$2,504	$4	Saudi Arabia $719; United Arab Emirates $581; Oman $277.
Diamond: Gem, cut and uncut do.	$504,231	$665,045	$174,260	Belgium-Luxembourg $197,820; Hong Kong $74,541; Japan $61,935.
Feldspar	14,647	NA	NA	NA.
Fertilizer materials:				
Crude: Phosphatic	--	146	--	Sri Lanka 86; West Germany 60.
Ammonia value	$3,805	NA	NA	NA.
Graphite, natural	44	NA	NA	NA.
Gypsum and plasters	11,182	NA	NA	NA.
Kyanite and related materials:				
Kyanite:				
Calcined	2,778	NA	NA	NA.
Other	6,052	NA	NA	NA.
Total	8,830	3,575	--	Netherlands 1,273; Belgium-Luxembourg 1,194; Switzerland 500.

See footnotes at end of table.

Table 2.—India: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[r]	1978	Destinations, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Kyanite and related materials —Continued				
Sillimanite	550	NA	NA	NA.
Other	1,314	NA	NA	NA.
Lime	8,851	5,716	--	Bangladesh 2,318; Kuwait 1,600; United Arab Emirates 915.
Magnesite:				
Crude	3,105	NA	NA	NA.
Calcined except dead-burnt	8,697	NA	NA	NA.
Dead-burnt	1,276	NA	NA	NA.
Total	13,078	6,888	1,104	Netherlands 2,250; West Germany 1,555; United Kingdom 1,412.
Mica:				
Crude including splitting and waste	15,235	14,668	3,006	Japan 3,746; Belgium-Luxembourg 1,568; Czechoslovakia 1,219.
Worked including agglomerated splittings	7,981	8,914	112	Iran 1,432; Norway 1,068; West Germany 765.
Pigments, mineral including processed iron oxides	5,233	NA	NA	NA.
Precious and semiprecious stones except diamond:				
Natural value, thousands	$22,911	$45,803	$9,606	Hong Kong $8,213; France $4,407; Switzerland $4,215.
Manufactured do.	$472	$741	$145	Singapore $253; Italy $51; U.S.S.R. $47.
Salt	244,323	18,747	--	Nepal 18,347; Maldive Islands 400.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	2,910	NA	NA	NA.
Caustic potash	583	NA	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	174,291	163,508	2,672	Japan 106,432; Italy 18,694; Kuwait 7,434.
Worked	11,298	9,932	131	United Arab Emirates 4,366; Japan 1,520; Netherlands 1,446.
Dolomite	7,497	NA	NA	NA.
Limestone for lime manufacture	137,657	165,974	NA	Bangladesh 140,179; Nepal 8,430.
Gravel and crushed rock	15,123	13,248	--	Kuwait 5,295; United Arab Emirates 3,489.
Quartz and quartzite	8,328	NA	NA	NA.
Sand excluding metal-bearing	418	16,005	--	West Germany 12,500; Iran 2,000; United Arab Emirates 736.
Sulfur:				
Elemental	821	791	--	Sri Lanka 443; Kenya 347.
Sulfuric acid, oleum	1,784	NA	NA	NA.
Talc, steatite, soapstone	18,077	12,459	NA	Kenya 2,752; Japan 2,445; United Kingdom 1,525.
Other:				
Crude value, thousands	$34,813	$40,206	$2,993	U.S.S.R. $8,677; Iraq $4,095; Iran $4,002.
Slag and waste, not metal-bearing	30	NA	NA	NA.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	178	NA	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	67,268	50,798	114	United Arab Emirates 28,769; Kuwait 9,071; Saudi Arabia 3,636.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	390	NA	NA	NA.
Carbon black	4,830	NA	NA	NA.
Coal, all grades including briquets	629,429	445,651	--	Bangladesh 194,976; France 127,266; Burma 54,523.
Coke and semicoke	14,818	4,985	--	Burma 3,900; Nepal 985; Yemen Arab Republic 100.
Gas:				
Natural value, thousands	--	$1	--	All to Nepal.
Manufactured do.	--	$83	--	Japan $45; United Kingdom $26; Afghanistan $7; Malaysia $5.

See footnotes at end of table.

Table 2.—India: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977[r]	1978	Destinations, 1978	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:[3]				
Gasoline thousand 42-gallon barrels	174	314	--	Nepal 313; Bangladesh 1.
Kerosine and jet fuel ---do---	380	158	--	Nepal 156; Bangladesh 1.
Distillate fuel oil ---do---	218	193	--	Nepal 192; Bangladesh 1.
Residual fuel oil ---do---	146	6	--	Mainly to Nepal.
Lubricants value, thousands	--	$732	--	Nepal $692; Bangladesh $24; Kenya $9.
Unspecified 42-gallon barrels	--	28	--	Kuwait 14; Singapore 7.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	35	20,238	--	France 20,000; Bangladesh 226; Nepal 10.

[r]Revised. NA Not available.
[1]Quantity for 1978 not available; 35,795 tons exported in 1977.
[2]Lead metal exports in 1977 were 20 tons with the value not available.
[3]May include metallic oxides listed in this table as not available.

Table 3.—India: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina	524	620	165	West Germany 284; Belgium-Luxembourg 34; Netherlands 22.
Metal including alloys, all forms	4,900	24,427	1,080	West Germany 5,387; Netherlands 5,011; Italy 4,505; France 4,127.
Antimony:				
Ore and concentrate, gross weight	1,453	106	--	Bolivia 91; Thailand 14; Singapore 1.
Oxides and hydroxides	126	114	1	United Kingdom 74; Belgium-Luxembourg 25; Netherlands 6.
Metal including alloys, scrap and unwrought	524	703	129	China, mainland 182; Taiwan 193; Netherlands 64.
Arsenic:				
Crude sulfides	21	7	--	Iran 3; Taiwan 3.
Oxide and acid	[r]676	685	--	France 391; Belgium-Luxembourg 162; Netherlands 50.
Elemental	24	10	--	Singapore 5; Sweden 5.
Beryllium metal including alloys, scrap and unwrought kilograms	369	54	17	West Germany 25; Austria 12.
Bismuth metal including alloys, scrap and unwrought	19	99	(1)	Singapore 50; Japan 22; Netherlands 13.
Cadmium:				
Oxides and hydroxides kilograms	606	400	--	All from Japan.
Metal including alloys, unwrought	6	59	(1)	Japan 30; Australia 27; Mexico 2.
Chromium:				
Oxides and hydroxides	--	5	--	Mainly from United Kingdom.
Metal including alloys, scrap and unwrought	25	37	(1)	United Kingdom 18; Japan 16; France 3.
Cobalt:				
Oxides and hydroxides	5	3	--	Belgium-Luxembourg 2.
Metal including alloys, scrap and unwrought	138	139	(1)	Zaire 82; Belgium-Luxembourg 47; West Germany 9.
Copper:				
Oxides and hydroxides	--	8	--	United Kingdom 6; Japan 2.
Metal including alloys:				
Scrap	16,305	15,755	5,140	Singapore 5,294; Kuwait 1,982; Malaysia 744.
Unwrought	26,746	60,172	13	Zambia 30,266; West Germany 24,884; Tanzania 2,861.
Semimanufactures	4,071	5,820	249	Japan 1,459; West Germany 1,245; Zambia 1,200.

See footnotes at end of table.

Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Ore and concentrate except roasted pyrite	1,037	301	180	Spain 121.
Roasted pyrite	16	163	5	Spain 158.
Metal:				
Scrap	45,073	116,118	29,235	United Kingdom 38,358; France 12,714; Belgium-Luxembourg 6,664.
Pig iron and cast iron	6	--		
Sponge iron, powder, shot	1,032	803	12	Sweden 718; West Germany 46; France 15.
Ferroalloys	813	4,515	81	France 3,032; Japan 985; Italy 100.
Steel, primary forms	4,794	3,744	4	West Germany 858; United Kingdom 827; Sweden 786.
Semimanufactures:				
Bars, rods, angles, shapes, sections	56,953	85,461	333	Japan 28,888; West Germany 24,298; United Kingdom 21,255.
Universals, plates, sheets	314,812	522,128	11,470	Japan 131,195; West Germany 120,392; United Kingdom 66,359.
Hoop and strip	11,916	13,128	1,146	Japan 4,252; West Germany 2,618; United Kingdom 2,388.
Rails and accessories	639	187	--	United Kingdom 148; U.S.S.R. 24; West Germany 15.
Wire	2,576	5,116	1,543	Japan 1,432; West Germany 1,002; United Kingdom 579.
Tubes, pipes, fittings	120,258	80,711	1,897	Japan 31,524; West Germany 16,524; United Kingdom 9,286.
Castings and forgings, rough	2,057	1,260	43	Japan 502; West Germany 393; United Kingdom 190.
Lead:				
Ore and concentrate	20	101	--	Morocco 82; France 15; Singapore 4.
Oxides and hydroxides	3	272	272	
Metal including alloys:				
Scrap	1,036	1,912	(1)	United Arab Emirates 872; Bahrain 327; Tanzania 200; Kenya 180.
Unwrought	46,637	24,967	--	Australia 10,949; West Germany 1,600; Zambia 1,140.
Semimanufactures	556	1,528	1	Spain 1,505; Japan 17; United Kingdom 5.
Magnesium metal including alloys, scrap and unwrought	205	617	422	Norway 80; Japan 68; Canada 20.
Manganese:				
Ore and concentrate	5,048	4,045	2,534	Singapore 1,066; United Kingdom 245; Gabon 200.
Oxides and hydroxides	279	330	1	Japan 244; Singapore 40; Belgium-Luxembourg 35.
Metal including alloys, scrap and unwrought	218	152	2	France 50; Japan 46; Norway 4.
Mercury 76-pound flasks	9,692	10,158	--	Italy 4,946; Spain 2,768; Taiwan 1,501.
Molybdenum:				
Ore and concentrate	173	173	80	United Kingdom 88; Japan 4; West Germany 1.
Metal including alloys, scrap and unwrought	14	19	1	Chile 5; Sweden 4; Czechoslovakia 3.
Nickel metal including alloys:				
Scrap	1,227	2,577	347	Sweden 380; France 375; West Germany 370; United Kingdom 367.
Unwrought	4,756	3,606	7	Canada 1,293; United Kingdom 894; Norway 396.
Semimanufactures	1,244	2,034	40	Canada 802; Japan 379; United Kingdom 320.
Platinum-group metals including alloys, unwrought and partly wrought troy ounces	12,386	13,216	39	U.S.S.R. 8,038; Switzerland 3,241; West Germany 763.
Selenium, elemental	81	29	--	Japan 14; Norway 12; United Kingdom 1.
Silicon, elemental	485	1,144	6	Norway 812; France 117; West Germany 101.
Silver metal including alloys, unwrought and partly wrought troy ounces	30,191	13,655	3,448	West Germany 6,237; United Kingdom 3,970.
Tantalum metal including alloys, scrap and unwrought kilograms	1,033	1,135	583	West Germany 225; Austria 150; United Kingdom 139.
Tellurium, elemental do	550	719	--	West Germany 700; Singapore 19.

See footnotes at end of table.

Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Tin:				
Oxides, hydroxides, peroxides	r550	138	120	Japan 13; United Kingdom 5.
Metal including alloys:				
Scrap	2,995	4,551	499	United Kingdom 2,181; West Germany 762; Belgium-Luxembourg 540.
Unwrought	2,359	1,793	(1)	Malaysia 1,792; Netherlands 1.
Semimanufactures	100	31	(1)	Malaysia 25; West Germany 4; United Kingdom 2.
Titanium:				
Oxides	4,756	6,038	4	United Kingdom 4,181; West Germany 836; Australia 340.
Metal including alloys, unwrought	10	20	13	United Kingdom 7.
Tungsten:				
Ore and concentrate	403	342	17	Thailand 280; Zaire 37; Republic of Korea 7.
Metal including alloys, scrap and unwrought	5	12	2	Netherlands 4; Czechoslovakia 2; West Germany 1.
Zinc:				
Ore and concentrate	19,001	83,212	--	Australia 33,010; Canada 29,884; Peru 20,185.
Oxides and hydroxides	17	75	11	Australia 50; United Kingdom 12; West Germany 2.
Metal including alloys:				
Scrap	--	1,015	--	Netherlands 414; Sweden 313; United Kingdom 135.
Unwrought	62,156	56,496	350	Zambia 11,967; Canada 10,041; Australia 7,980; Zaire 7,385.
Semimanufactures[2]	1,816	1,417	12	Canada 751; Australia 82; New Zealand 67.
Zirconium:				
Ore and concentrate	--	5	--	All from the United Kingdom.
Metal including alloys, unwrought	1	56	10	Japan 45; United Kingdom 1.
Other:				
Ores and concentrates	r278	126	50	Malaysia 50; Chile 10; Singapore 10.
Metals:				
Metalloids	138	36	1	Japan 34; United Kingdom 1.
Alkali, alkaline-earth, rare-earth metals	2	19	5	United Kingdom 7; Japan 5; West Germany 2.
Base metals including alloys, scrap and unwrought	87	107	1	Norway 62; Japan 17; France 11; United Kingdom 8.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Tripoli earth	122	17	17	
Other kilograms	725	440	--	All from United Kingdom.
Dust and powder of precious and semiprecious stones except diamond do	229	64	14	United Kingdom 35; Switzerland 7; Ireland 5.
Grinding and polishing wheels and stones	495	266	63	Japan 57; West Germany 44; United Kingdom 36; Czechoslovakia 31.
Asbestos, crude	65,786	45,432	272	U.S.S.R. 19,998; Canada 19,699; Australia 1,742.
Boron materials:				
Crude natural borates	6,000	301	--	Turkey 300; Denmark 1.
Oxide and acid	6	3	--	All from Japan.
Bromine, elemental	528	162	5	Italy 100; Israel 41; East Germany 11.
Cement	336	1,143,379	18	Republic of Korea 535,620; North Korea 303,222; Romania 136,230.
Clays and clay products:				
Crude clays	8,161	1,577	295	West Germany 739; Japan 404; United Kingdom 108.
Products:				
Refractory including nonclay brick	r4,589	8,751	1,010	Czechoslovakia 4,172; Poland 1,200; United Kingdom 713.
Nonrefractory	30	75	1	West Germany 45; Nepal 13; Japan 10.
Cryolite and chiolite	r300	5	--	All from Denmark.

See footnotes at end of table.

Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Diamond:				
Gem ——— value, thousands	$329,049	$534,125	$1,781	Belgium-Luxembourg $320,087; United Kingdom $190,443; Zaire $9,058.
Industrial ——— thousand carats	775	3,330	100	Ghana 2,465; United Kingdom 215; Belgium-Luxembourg 160.
Diatomite, kieselguhr, other infusorial earth	980	230	92	Italy 92; Spain 25; Kenya 20.
Feldspar and fluorspar	r4,753	5,003	3	Thailand 5,000.
Fertilizer materials:				
Crude:				
Phosphatic ——— thousand tons	2,309	830	228	Morocco 286; Jordan 259; Senegal 49.
Potassic	13,000	23	—	France 22; Japan 1.
Manufactured:				
Nitrogenous — thousand tons	1,199	1,910	274	Netherlands 334; U.S.S.R. 206; Romania 174.
Phosphatic	—	197,565	194,340	Belgium-Luxembourg 1,500; U.S.S.R. 1,426; Netherlands 299.
Potassic	731,728	552,439	7	Canada 309,593; West Germany 199,518; East Germany 40,627.
Other including mixed	221,020	333,054	178,596	West Germany 45,153; East Germany 43,426; Canada 27,119.
Fluorine, elemental ——— kilograms	37,217	10	—	All from the United Kingdom.
Graphite, natural	698	539	11	Madagascar 311; Sri Lanka 145; West Germany 50.
Gypsum and plasters	22	.6	3	United Kingdom 3.
Iodine, elemental	225	222	—	Japan 219; Spain 2; United Kingdom 1.
Lime	4	20	—	All from Japan.
Magnesite, crude	30	7,639	2	Greece 7,630; West Germany 6.
Mica, worked including agglomerated splittings	56	145	(1)	U.S.S.R. 109; United Kingdom 22; Switzerland 12.
Pigments, mineral:				
Iron oxides, processed	2,420	1,279	21	Iran 1,006; West Germany 215; Japan 32.
Other	27	2	2	
Precious and semiprecious stones except diamond:				
Natural ——— value, thousands	$9,336	$8,259	$1,808	Brazil $2,069; United Kingdom $1,717; Switzerland $1,234.
Synthetic and reconstructed — do	$133	$201	$10	France $66; United Kingdom $52; Switzerland $34.
Salt and brine	564	1,042	—	Pakistan 966; Singapore 51; Thailand 17.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	101	46	46	
Caustic potash	1,504	55	1	Sweden 35; West Germany 7; Japan 7; Czechoslovakia 5.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked ———	19	28	—	Nepal 15; Italy 11; Switzerland 2.
Worked	(4)	141	—	Italy 40; United Kingdom 35; Nepal 25.
Gravel and crushed rock:				
Quartz	r4	19	19	
Other	16	258	21	Hong Kong 140; West Germany 46; France 23.
Limestone except dimension	—	12	—	All from West Germany.
Sulfur:				
Elemental	767,305	818,168	(1)	Iraq 264,848; Iran 204,472; Canada 139,440; Kuwait 105,185.
Sulfuric acid, oleum	1	3	2	West Germany 1.
Talc, steatite, soapstone, pyrophyllite	—	14	—	Mainly from Nepal.
Other:				
Crude:				
Meerschaum, amber, jet	—	10	—	All from Singapore.
Unspecified	15,540	8,546	8,054	Iraq 175; Greece 77; Iran 71.
Slag and ash, not metal-bearing	—	5,550	—	All from Republic of Korea.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	297	159	32	Japan 62; United Kingdom 26; Australia 23.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	1,189	161	11	United Kingdom 49; Japan 33; West Germany 32.

See footnotes at end of table.

Table 3.—India: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,237	1,681	1,647	United Kingdom 27; Taiwan 5; West Germany 2.
Carbon black and gas carbon:				
Carbon black	1,885	1,885	109	Japan 1,259; West Germany 325; France 119.
Gas carbon kilograms	r70	32	32	
Coal, all grades including briquets	r2,815	1,613	2	Japan 1,592; Australia 11; Canada 6.
Coke and semicoke	124	--		
Gas, natural and manufactured value	$2,540	--		
Hydrogen, helium, rare gases value, thousands	$585	$1,202	$101	Iran $775; United Kingdom $88; Australia $81.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	109,739	107,521	--	Iraq 36,201; Iran 29,384; Saudi Arabia 15,130.
Refinery products:[5]				
Kerosine and jet fuel do	8,068	12,082	NA	NA.
Distillate fuel oil do	5,095	7,997	NA	NA.
Residual fuel oil do	4,649	5,741	NA	NA.
Lubricants do	161	231	NA	NA.
Other do	2,205	3,043	NA	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	834	--		

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Includes blue powder.
[3]Incomplete figure; excludes data for January-March.
[4]Value only reported at $37,719.
[5]Data are from the International Petroleum Annuals, 1977 and 1978. Official trade statistics do not report petroleum refinery products under the categories listed. Instead, all products are listed in three categories as follows, with quantities given in metric tons: 1977—light distillates 524,061, middle distillates 1,492,543, other 351,298; 1978—light distillates 383,586, middle distillates 2,629,185, other 865,908.

COMMODITY REVIEW

METALS

Bauxite, Alumina, and Aluminum.—The aluminum industry[6] continued to have problems of low capacity utilization during a period of increasing demand. Production of metal during fiscal year 1980-81 averaged about 58% of the currently installed and operable aluminum smelting capacity. Total production by the end of fiscal year 1980-81 showed a small decline for the second straight year after hitting a high of 214,000 tons of primary metal in 1978.

Persistent power shortages and the high cost of raw material input such as caustic soda, fuel oil, aluminum fluoride, etc., hampered the performance of the industry throughout fiscal year 1980-81. Actual requirements for aluminum in 1980 were estimated at 300,000 tons, calling for imports on the order of 100,000 tons.

India's aluminum smelter capacity, as reported by the Ministry of Steel and Mines, was as follows, in tons per year:

Name	Location	Existing capacity	Proposed expansion
Public sector:			
Barat Aluminium Co., Ltd	Korba, Madhya Pradesh	100,000	--
National Aluminium Co., Ltd	Talcher, Orissa	--	218,000
Private sector:			
Indian Aluminium Co., Ltd	Hirakund, Orissa	20,320	4,150
Do	Alwaye, Kerala	15,850	--
Do	Belgaum, Karnataka	60,000	--
Hindustan Aluminium Co., Ltd	Renukoot, Uttar Pradesh	100,000	20,000
Madras Aluminium Co., Ltd	Mettur, Tamil Nadu	25,000	--
Total		321,170	242,150

The 9,000-ton-per-year smelter at Jaykaynagar in West Bengal has been closed for several years.

There was considerable controversy during the year about the price of aluminum, which was controlled by the Government. According to industry sources, the increasing costs for raw materials, if not compensated by higher prices, could lead to further cuts in production. Reportedly, producers were losing on the average about $312 per ton of metal output. The Ministry of Steel and Mines recommended a $312 to $375 per ton increase in price. The Ministry of Energy, however, vigorously opposed the increase on the grounds that it would jeopardize its ambitious program for expanding electric power generating capacity and the rural electric power distribution network. Some suggested that aluminum producers would not benefit in the medium term by a price increase, since although they could charge more for their aluminum they might face further power cuts due to delays in the electric power program.

Unlike the consumption pattern for the United States or Western Europe, where the electric cable industry accounts for about 11% of aluminum produced, this sector in India accounted for nearly 60% of the metal consumed.

The controversy was settled at the end of fiscal year 1980-81 with the announcement of a $346-per-ton increase effective March 27, 1981. The increase brought the price of electric conductor-grade aluminum to $2,330 per ton.

Provisional bauxite production figures showed a decline in 1980 reflecting the lowered demand from the aluminum smelters. Maharashtra, Madhya Pradesh, Bihar, and Gujarat produced over 90% of India's bauxite, the great majority being consumed by the aluminum industry. The remainder was used by the chemical, refractory, abrasives, cement, and steel industries.

During 1980, a major new bauxite deposit was reported on the Gandhamardan plateau in the Bolangir-Sambolpur District. Reserves were not yet determined. Both Bharat Aluminium Co. (BALCO) and Orissa Mining Corp. expressed interest in the deposit.

India ranked about fifth in the world in bauxite reserves, with about 76% being located along the east coast of Orissa and Andhra Pradesh. As exploration and more detailed examination continued, the total reserves of 2.3 billion tons of all grades were expected to increase considerably.

The much publicized Orissa bauxite and aluminum complex was approved for construction during the year. A separate, Government-owned corporation named National Aluminium Co. Ltd. (NALCO) was set up to implement the project, which will cost over $1.5 billion when completed. The project will be heavily aided by the French Government and the Aluminum Pechiney Co. of France. The French Government agreed to loan $400 million, and $680 million will be loaned by a syndicate of 48 banks in Europe, guaranteed by the Government of India. The remainder will be furnished by Indian Government funding.

Three Orissa bauxite deposits were examined in detail to determine which would be the most economical to develop for the project. The Panchpatmali deposit contained 377 million tons of ore at 40% Al_2O_3 cutoff. Average grade was 47% Al_2O_3 and 2.1% silica. The other two deposits, Gandhamardhan and Pottangi, contained 231 million tons and 92 million tons, respectively, also with good ore composition. The central ore block of the Panchpatmali deposit was chosen as the site for the mining operation. It was located near the Andhra Pradesh border and about 110 kilometers from the coast. The deposit caps a hill about 450 meters above the adjoining plain and is 12 to 14 meters thick with 1 to 3 meters of overburden.

The mine at Panchpatmali will be fully mechanized and developed in two stages of 1.2 million tons per year each. Standard open pit equipment will be used—4.6-cubic-meter electric shovels loading 32-ton rear dumpers. The mine is to employ 900 workers.

The alumina plant will be at Damonjodi 23 kilometers from Koraput (18°49'N, 82°43'E) and have two production lines of 400,000 tons per year each. About 450,000 tons per year would be utilized for conversion to metal and the balance of 350,000 tons per year would be exported to France on a buy-back agreement to pay off the loan. The alumina plant would employ 1,800 people. The alumina will be transported via railroad either to Visakhapatnam for export or to the site of the new smelter near Talcher (20°57'N, 85°13'E). The smelter will have two 240-cell potlines of 109,000 tons per year capacity each. Design power consumption is to be 13,540 kilowatt-hours per ton of metal. All cells will have fume hoods and the latest environmental controls. The

smelter and anode plant will employ a total of 2,040 persons.

The choice of Talcher for the smelter site was governed by the need for a reliable source of electric power. A 700- to 800-megawatt thermal powerplant will be built for the exclusive use of the smelter. Smelter and powerplant will be located close to a new, captive 3.5-million-ton-per-year coal mine and a coal washing plant.

Plans for the U.S.S.R.-backed export-oriented Andhra Pradesh bauxite and alumina project did not progress much during 1980. The Soviet feasibility report estimated cost of a 600,000-ton-per-year alumina plant, including infrastructure, at $548 million, or a 800,000-ton-per-year plant at $663 million.

The initial Soviet report called for an 80% import component, which was entirely unacceptable to the Government of India. In later discussions, the Soviets were willing to finance only 15% of the cost with the balance to be funded by India. India was reluctant to furnish the funding and did not have a long-term alumina customer lined up. It was very unlikely that the U.S.S.R. would accept more than 50% of the plant output. India had reportedly already ruled out export of bauxite to the U.S.S.R. in place of alumina.

In light of the Soviets' hesitancy to finance the majority of the cost, there was a good possibility that the project would be further delayed.

Exploration for additional bauxite in the Kutch District of Gujarat continued during 1980. A deposit of 10 million tons of high-grade bauxite was added to the known reserves bringing the total to 85 million tons. The Gujarat Government planned to establish a joint sector alumina project using the Kutch ores. A technical collaborator was being sought at yearend.

BALCO's proposal for bringing its alumina production line at Korba up to design capacity of 200,000 tons per year was approved by the Government. The achievable operating capacity was 150,000 tons per year. In addition to the alumina plant upgrading, the electrical-grade wire rodmill was also under expansion to meet the growing demand for electric cable. Both projects were scheduled for completion during 1981.

The third and fourth potlines at the BALCO smelter were not started as planned during fiscal year 1980-81 and the prospect for their startup in fiscal year 1981-82 remained poor. The two 25,000-ton-per-year potlines were ready for commissioning in December 1977 and August 1978 but were never energized because of nonavailability of electric power.

The Geological Survey of India is to carry out reassessment and exploration for new occurrences of bauxite of the leasehold of Madras Aluminium Co. in the Shevaroy hills in Tamil Nadu. The company is facing a shortage of metallurgical-grade bauxite for its plant at Mettur.

India's demand for imported aluminum could be as high as 130,000 tons in fiscal year 1980-81. Supplies of electric conductor grade were particularly tight during the year. Minerals and Metals Trading Corp. (MMTC) reportedly had over 25,000 tons of electric conductor ingot in warehouses, which could not be released because of problems over payment of import duty. The Government had waived the aluminum import duty in April 1980 in order to encourage imports to fill the domestic shortage. The duty waiver was canceled in September 1980. Reimposition of the duty caused problems for dealers who had ordered metal after April but were not able to receive delivery before September. Slow distribution and delivery of metal to the consumers also caused further problems during the year.

Chromite.—There was a marginal increase in chromite production during the year, but mine value dropped slightly to $15.8 million in 1980 compared with $16.8 million in 1979.

Much of the Indian chromite production was for the export market. The Government's export quota was changed from 266,000 tons in 1979 to 300,000 tons in 1980, although the quota for high-grade ore, included in this figure, was lowered from 160,000 tons to 137,000 tons. The price of high-grade ore bought by Japan, India's major customer, was $110 per ton for the 1980 contract, an increase of $2 per ton over the 1979 price.

Test drilling for additional chromite reserves was under way by the Geological Survey of India and the Mineral Exploration Corp. (MEC) in several locations. A test boring at Kimsibura, Singhbhum District, Bihar, encountered an encouraging vein of chromite. Work in the adjacent Jamliuli, Ranjrakocha, and Janao areas was continuing. Mapping and surface evaluation was underway in the Krishna, Khammam, and West Godavari Districts of Andhra Pradesh, and in Hassan District of Karnataka.

As a result of the continuing exploration program, the reserve picture for chromite was much more favorable than a few years ago. Officially quoted at 60 million tons of over 30% Cr_2O_3 ore, the figure could go over 100 million tons in the next few years. A large part of the total increase in recent years was from changing technologies that allowed for the redefining as ore, certain lower grade deposits, deposits with lower Cr:Fe ratios, and friable deposits formerly considered unusable.

Based on the improved reserve picture in Orissa and the feasibility of using lower grade chromite fines, three export-oriented charge chrome plants were planned. The Orissa Mining Corp. was to build the first 50,000-ton-per-year plant at a cost of around $35 million. Outo Kumpu Oy of Finland was to provide technical expertise and Voest Alpine A.G. of Austria was to supply the equipment. The plant will have an electric arc furnace using a sinter pellet feed. Furnace waste gases will be used to preheat the pellets, saving an estimated 30% in electric power consumption.

Ferroalloy Corp. was also issued a letter of intent for a similar plant to be built at Baudpur in Balasore District of Orissa at a cost of $25 million. The company will also expand the production from its Boula chromite mine and construct a 450-ton-per-day beneficiation plant. The mine has been an open pit operation, but the workings will be extended underground as well.[9]

The Indian Metals and Ferroalloys Ltd., which already operates a ferrosilicon plant in Orissa, has proposed a third 50,000-ton-per-year charge chrome plant.

Copper.—The Indian copper industry continued to have serious problems of under utilization of designed smelter and refinery capacity during 1980. The Khetri copper complex of Hindustan Copper Ltd. (HCL) with a design capacity of 31,000 tons of copper metal per year was particularly hard hit. Mine development, mine production, and ore milling suffered from frequent power outages and cutbacks of up to 50% of its operational needs. With the power restrictions, the smelter and refinery were given priority and the mining operations as well as the byproduct fertilizer plant suffered as a result.

HCL was having feasibility reports prepared to examine the expansion of Khetri's smelter and refinery up to 45,000 tons per year. HCL felt the increase was necessary to handle anticipated increases in local ore production and the copper concentrate that will be available from Malanjkhand. HCL has ordered two 3,500-kilowatt diesel generator sets for the Khetri complex to augment the standby power capacity and ensure that essential mining and plant operations can continue during a shutdown caused by power outages. The often unannounced power outages have caused damage to equipment in the past.

Excavation and equipping were completed on the new deep shaft at the Kolihan Mine, one of the main sources of copper ore for the Khetri complex. Installation of the underground crusher was underway. Completion of this deep mine development will eliminate long underground ore hauls that contribute to ore handling bottlenecks in the mine. The new shaft will permit a production increase from the present capacity of 1,500 tons per day to 2,500 tons per day.[10]

At the Ghatsila copper complex in Bihar, power shortages during fiscal year 1979-80 caused a considerable loss of ore production and the liquidation of the concentrate stockpile.

A mine expansion was underway at the Mosaboni Mine, one of the main ore suppliers to the Ghatsila complex. The project, which would increase monthly ore production from 50,000 tons to 80,000 tons, ran into power problems, and progress was adversely affected during 1980. HCL has proposed an expansion of its Ghatsila refinery capacity from 16,500 tons per year to 20,000 tons per year. Mitsubishi Metal Corp. of Japan has reportedly been selected to supply the electrolytic technology.

Development of the Malanjkhand copper project in Balaghat District of Madhya Pradesh continued during the year. Overburden removal totaled 1.2 million cubic meters during fiscal year 1979-80 and was estimated at 2.57 million cubic meters during fiscal year 1980-81. Work on the ore concentration plant proceeded generally on schedule.

This project will be the country's first large-scale open pit copper mine. The mine will be designed to produce 2 million tons per year of ore (23,000 tons copper equivalent) and the concentrator scaled accordingly. The first phase of the program will produce 1 million tons per year of ore and was scheduled for startup in July 1982. The Government of India's estimated cost of the project has been revised from $107 million up to $115 million with a 10% foreign

exchange component. The Malanjkhand ore body contains an estimated 117 million tons of ore averaging 1.13% copper, or roughly one-quarter of the country's known copper reserves. Rio Tinto Zinc of the United Kingdom was the prime consultant on the project. A prototype test leaching facility was set up to recover oxydized and low sulfide ore. Copper concentrates will be shipped to the Khetri smelter where they will supplement the concentrates available from HCL's local mines.

Gold.—Gold was produced in modest amounts from the old Kolar Goldfield and from Hutti Gold Mines Co., Ltd., both in Karnataka, and from HCL's precious metal byproduct plant at the Ghatsila copper complex. In addition, a byproduct recovery plant, under construction at the Debari smelter in Rajasthan, will recover silver and about 10 kilograms of gold per year from the zinc concentrate. The recovery plant was scheduled for completion in late 1982.

The miners at the Kolar Goldfield celebrated the 100th anniversary of active mining in 1980. The mines were among the deepest active workings in the world. Past production totaled 785 tons of gold from 46 million tons of ore. However, unstable ground, fire, water problems, and low-grade ore were contributing to the high mining costs and low economic return.

The Geological Survey of India has been actively exploring for additional reserves at both Kolar and Hutti and in a number of other States where low-grade deposits were being reexamined in light of the current high price of gold.

Bharat Gold Mines Ltd., the public sector company that operates the Kolar Mines, planned to reopen the Yeppamana Mine near Anantapur (14°41'N, 77°36'E) in Andhra Pradesh. The mine was one in the old Ramagiri Goldfield run by the former John Taylor and Sons Co. of Great Britain. The mines have been closed since 1929 when costs exceeded the value of production. The Geological Survey of India reportedly reopened the old shaft, and exploration work was underway during 1980. Production was projected to begin within 2-1/2 years of an investment decision. The mine would operate at a rate of 250 tons per day from proved reserves of 300,000 tons of 5.5-gram-per-ton ore.

Iron Ore.—Iron ore[11] production rose marginally in 1980, with the mines in the Goa area contributing one-third of the total. Lump ore accounted for about 54% of the total. In 1979, the latest available data, there were 358 reporting iron ore mines with the largest number located in Goa where mining was predominantly in the private sector. Madhya Pradesh, Orissa, Bihar, and Karnataka together produced about 63% of the iron ore, mostly from public sector mines.

The public sector National Mineral Development Corp. (NMDC), which operated highly mechanized, export-oriented mines at Bailadila in Madhya Pradesh and Donimalai in Karnataka continued to be the largest producer of non-Goan iron ore. In 1980, NMDC's production was 7 million tons with roughly 85% consisting of lump ore. In contrast, nearly 90% of the Goan ore consisted of fines. Meanwhile, the stockpile of fines at Bailadila continued to grow to an estimated 15 million tons. Efforts to promote the export of these fines have met with limited success, with Romania, Japan, and Yugoslavia buying a total of 4 million tons in 1980. A proposed pelletization plant at Bailadila was further delayed by priority being given to establishing a pellet plant at Mangalore to increase the salability of Kudremukh iron ore concentrate.

One of the major iron ore developments during 1980 was the completion in August, ahead of schedule, of the $630 million Kudremukh iron ore project. The output from this project, which was to reach 7.5 million tons per year in the third year of operation, was initially earmarked for Iran. Project financing was also to come from Iran, but owing to internal political problems exacerbated by the Iranian-Iraqi war, Iran advanced only $255 million toward the project cost. One of the two planned Iranian steel plants that was to use the Kudremukh concentrate has been canceled and construction on the other, at Ahwaz, has been delayed at least 3 years. Physical status of the Ahwaz plant, which was located in a reported combat area, was not determined at yearend 1980. Iran's inability to lift any of the concentrate has created a number of operational and financial problems for the Kudremukh Iron Ore Co. Ltd. (KIOCL). It was unclear at yearend if Iran was going to continue financing the project, attempt to negotiate a new contract, or try to recover its investment.

Meanwhile, the Government has been negotiating with several countries including Bahrain, Indonesia, Malaysia, Romania,

and others for the sale of the concentrate. Romania has accepted a trial shipment of 40,000 tons and reportedly has agreed to lift 1 million tons per year over the next 3 years as part of a buy-back arrangement involving a contract to build a 3-million-ton-per-year pellet plant at Mangalore. Lurgi of the Federal Republic of Germany would provide the pelletization technology. Romania's offer was reportedly the lowest of five international bids submitted and contained the ore purchase agreement as well. The Arab Iron and Steel Co. of Bahrain has reportedly agreed to buy 1.5 to 2.0 million tons of concentrate annually at a price to be determined.

In 1980, there were three relatively small pellet plants in India. These were the 0.5-million-ton-per-year captive Tata Iron and Steel Co. (TISCO) plant, and two export-oriented plants in Goa, a 1.0-million-ton-per-year plant operated by Chowgule Co. Pvt., Ltd., and a 1.8-million-ton-per-year joint Chowgule-NMDC plant also in Goa. High fuel oil costs were making it very difficult to operate the Goan plants at a profit. They were subject to temporary closure if the costs could not be passed on to the Japanese consumer. Both plants had plans to make modifications that would lower operating costs.

The Bailadila-14, Bailadila-5, and the Donimalai Mines operated at well under design capacity during 1980 because of lack of demand, railroad transportation bottlenecks, and the electric power shortages.

Exploration and development work continued on the most promising iron deposits. Of the eight main ore bodies at Bailadila, the detailed study of the 11-B deposit was scheduled for completion in March 1981 and the 11-C deposit was chosen for development to supplement the output of the operating Bailadila-14 Mine. In 1980, the NMDC completed field investigations or feasibility studies on the Bababudan and Kumaraswamy deposits in Karnataka, the Ongole magnetite deposit in Andhra Pradesh, and the Malangtoli deposit in Orissa.

Despite the depressed outlook for the steel industry worldwide particularly in Japan, Indian production of iron ore in fiscal year 1981-82 was expected to remain close to the fiscal year 1980-81 level because of the anticipated increased domestic demand and diversified overseas sales. The 6-year plan target called for a production of 60 million tons by fiscal year 1984-85. Indian iron ore consumption should amount to about 16 million tons in fiscal year 1981-82, rising to 23 million tons in fiscal year 1984-85, and to 30 million tons by fiscal year 1989-90.

Export earnings from the sale of iron ore and pellets in fiscal year 1980-81 rose to an estimated $411 million compared with $351 million in fiscal year 1979-80. Japan remained India's most important iron ore customer accounting for 60% of the total exports. Romania was the second largest buyer of Indian ore. U.S.S.R. for the first time imported Indian ore amounting to 2 million tons. Seven other countries bought at least 100,000 tons each in both fiscal year 1979-80 and fiscal year 1980-81.

Direct sales of iron ore by Goan producers last year declined by more than 2.5 million tons to about 8.5 million tons. This was attributed to reduced liftings by Japan, a strike by the inland bargemen who move most of the Goan ore to Mormugoa port for export, and other labor problems. The Goan mining companies also sold nearly 3.5 million tons of iron ore to MMTC for export. Total Goan mine production was 1 million tons more than the output in fiscal year 1979-80.

Steel.—Total Indian salable steel production during fiscal year 1980-81 rose slightly with the country's six integrated steel plants accounting for 6.12 million tons and the balance coming from 146 operating mini-steel plants. The small improvement fell short of meeting the demand of approximately 9.3 million tons. The near stagnation in production during 1980 was attributed to chronic shortages of power and coking coal as well as labor unrest. Average capacity utilization of the five public sector integrated plants was 63.5% while the private sector TISCO plant operated at 101.7% of its design capacity during the same period.

Steel production from the mini-steel plants continued to increase in fiscal year 1980-81. Major steps were being taken to promote the production from these plants. These included (1) allowing direct import of scrap metal, (2) import of about 30,000 tons of sponge iron from Indonesia on an experimental basis, and (3) exemption of excise duty on products made from indigenous sponge iron. India was also negotiating for the supply of up to 200,000 tons per year of sponge iron from Indonesia.

Output of crude steel declined in 1980 primarily because of a 600,000-ton stockpile accumulated by the public sector plants and, to a lesser degree, of shortages of power

and coking coal. Some of the inventory was carried over from the previous year when the power shortage in the rolling mills adversely affected the conversion of the crude steel to salable steel. Crude steel target for fiscal year 1981-82 was 9.15 million tons of which about 7.20 million were to come from SAIL plants. Chronic transportation bottlenecks, however, could make it a difficult goal to attain. Nevertheless, salable steel output was expected to pick up in fiscal year 1981-82 to as much as 9.0 million tons.

During fiscal year 1980-81, steel imports were valued at $625 million compared with $563 million in fiscal year 1979-80. Major suppliers were the United Kingdom, Japan, and the Federal Republic of Germany. In light of the persistent shortages, imports were likely to remain around 1 million tons over the next several years.

The Government had a continuing expansion program underway that would greatly increase India's steel production capacity by 1990. Current programs underway or approved were projected to raise the country's crude steel capacity from the present 14.7 million tons including mini-steel plants to nearly 19 million by yearend 1984. According to the Government's annual plan, expenditure for the steel sector in fiscal year 1981-82 was put at $950 million, with over half of that for expansion of Bokaro and Bhilai steel from 2.5 million tons to 4.0 million tons each by the end of 1982. Total sixth plan outlay for Bokaro and Bhilai was $1.01 billion and $1.14 billion, respectively. The Bokaro expenditure was to include the construction of a three 60-megawatt turbogenerator unit captive thermal powerplant. The mill has suffered serious power shortages in the past 2 years and operated at 40% to 43% of installed capacity during that period. The 6-year plan outlay of $528 million including $101 million in fiscal year 1981-82 was scheduled for the Rourkela plant, which included a silicon steel project to be completed by January 1982, captive powerplants, and other modifications. The Durgapur plant was allocated $70 million for a captive electric powerplant.

Work was nearing completion on the first stage of the Salem stainless steel plant in Tamil Nadu estimated to cost $175 million. The plant will have a capacity of 32,000 tons per year of cold-rolled stainless steel sheets and strips from imported feedstock. Plans call for doubling of the capacity.

The Government has allocated $163 million in fiscal year 1981-82 for the 3.4-million-ton Soviet Union aided Visakhapatnam steel plant. The first 1.15 million tons of capacity was scheduled for completion by fiscal year 1984-85 at a cost of $1.31 billion. Total cost of all stages was estimated at more than $3.24 billion. The Soviet Union has offered credit of $313 million for the first stage and an equal amount for the second. Site preparation and infrastructure construction was underway during 1980.

TISCO's plans called for a $425 million modernization program over the 1980-85 period. The TISCO integrated steel plant, oldest in the country, consisted of the 1.5-million-ton-per-year salable steel plant at Jamshedpur in Bihar; captive collieries at Sijua, Jamadoba, and West Bokaro; and the iron ore mine at Noamundi. The West Bokaro Colliery was being expanded and a coal washing plant was under construction. Half of the 50-year-old steelmaking capacity was to be replaced with a new oxygen-based steel converter shop. A 300,000-ton-per-year continuous casting line and vacuum arc degassing equipment will also be installed. The company estimated that nearly $9 million will be saved annually on fuel costs from the new melt shop. The new equipment will allow salable steel output to increase to about 1.75 million tons per year.

India's long-term program called for a crude steel capacity of 24 million tons by fiscal year 1989-90. The increase was to be achieved by commissioning the second stage of the Visakhapatnam steel plant and by building a 3.0-million-ton-per-year steel plant at the port city of Paradip (20°17'N, 86°42'E). Negotiations for a contractor were underway at yearend 1980. Financing of the project and technology being offered were the prime consideration in the choice of contractor.

The 30,000-ton-per-year sponge iron (direct reduction) demonstration plant became operational in July 1980. The plant operated by Sponge Iron India, Ltd., a government-owned company at Kothagudam, Andhra Pradesh, was set up with United Nations assistance using Lurgi's coal-based direct reduction process. The plant operated successfully through yearend, and plans were being made to double its capacity.

India's only commercially designed direct reduction plant, under the corporate name of Orissa Sponge Iron, Ltd., was nearing completion. Allis Chalmers Co. (United

States), which has provided the process know-how and equipment at a cost of $10.6 million, holds a 10% equity in the project. Trial runs of the $30 million, 150,000-ton-per-year coal-based plant were set for September 1981. Plans called for doubling the capacity of this plant also, if it operates as a commercial success.

TISCO has reportedly received approval to set up a plant in Orissa based on its own technology. Mini-steel plants were expected to buy most of the sponge iron output as a substitute for scarce and expensive ferrous scrap.

Lead and Zinc.—Power outages during most of February and March 1980 at the Debari lead-zinc complex in Rajasthan reportedly caused a production loss of around 1,200 tons of lead and 9,000 tons of zinc. Despite the problem, production of lead concentrates increased marginally for the year but zinc production dropped significantly.[12]

The Mochia and Balaria Mines and associated concentrator of the Zawar group of mines near Udipur, Rajasthan, continued to be the major source of lead-zinc ore and concentrate. The mining out of the upper level ore reserves at Mochia necessitated extending the workings to a greater depth. Construction was underway on two main shafts—Mochia and Balaria— and on an auxiliary shaft for Mochia. The auxiliary shaft was due for completion in 1981, and the main shafts, in 1982. Lower level development of the ore bodies will begin after completion of the shafts.

The Government sanctioned a $13 million expenditure for setting up a leach residue treatment plant at the Debari zinc smelter using a process and technical aid from Outokumpu Oy of Finland. When completed, the leach plant would add 4,000 tons per year capacity to the present 45,000 tons per year capacity. A silver and gold byproduct recovery plant using Mitsubishi process technology was also approved for the smelter. The plant would, for the first time, enable recovery of silver and gold values from the zinc concentrates. In addition to current production, the stockpiled residue of the past 11 years of operations at the smelter will also be treated. The planned annual recovery capacity will be about 10 kilograms of gold and 8,500 kilograms of silver. It was believed that the silver would be refined at the Visakhapatnam zinc smelter.

Construction continued on the Rajpura-Dariba lead-zinc mine and concentrator near Chittor, Rajasthan. Installation of the hoisting system was behind schedule by about 6 months. A tailings disposal plant was also ordered in 1980 for the treatment of concentrator tailings. The plant will deslime the tailings, then mix the sands with cement, and pump the mixture back to the mine for use in backfilling the worked-out stopes. Design output of the new mine will be 3,000 tons of ore per day.

Work continued on the $15 million Sargipalli lead mine in Orissa, which was being developed to reach a production of 500 tons of ore per day by late 1983. Construction on the concentration plant was to begin early in 1981. The Sargipalli project was designed for an annual yield of about 10,000 tons of 63% lead concentrate for the Visakhapatnam smelter. Proved reserves were 2.6 million tons of 6.7% lead ore.

At the Agnigundala lead mine in Guntur District, Andhra Pradesh, work on expanding the milling capacity from 100 to 200 tons per day of ore was completed except for installation of an additional crusher, which was underway. Doubling of the mining capacity to 240 tons of ore per day was also in progress.

The Rajasthan Government has granted a mining lease for the Rampura-Agucha lead-zinc deposit in Bhilwara District. A detailed investigation has been sanctioned. The property was the largest single lead-zinc deposit in India and had 30 million tons of proved reserves grading over 10% combined metal content. In view of the continuing need to import both lead and zinc, the Government was anxious to begin mining the deposit as soon as the economic viability of the project could be assured. The deposit was reportedly suitable for open pit exploitation. Also planned in conjunction with this deposit was a new smelter with a capacity of 100,000 tons per year of zinc and 35,000 tons per year of lead.

A proposal to expand the Visakhapatnam lead smelter from 10,000 tons per year to 22,000 tons per year was approved by the Government. Hindustan Zinc, Ltd. (HZL), has dropped its plans for expanding the 8,000-ton-per-year Tundoo smelter.

HZL's zinc smelter at Visakhapatnam was reportedly operating at 75% to 80% capacity on imported concentrate and was producing the majority of the country's zinc during the power shortage at Debari. A prolonged strike at Cominco Binani Zinc Co.'s 17,000-ton-per-year smelter near Al-

waye in Kerala had cut production there considerably during 1980. The labor problems were settled around yearend and operations were likely to resume in April 1981.

The status of lead-zinc ore reserves has been steadily improving as the Indian exploration programs added to total reserves and upgraded the classification of many reserves. As of January 1981, 29 distinct ore blocks have been evaluated and cataloged. Total ore reserves were 229 million tons averaging 4.72% zinc and 1.76% lead. Of the total, 148 million tons were classified as proved or probable. Estimated metal content of the proved and probable classes came to 7.5 million tons of zinc and 3.0 million tons of lead.

Manganese.—Production of manganese ore was valued at $29.0 million at the minehead in 1980, marginally higher than in 1979 because of a price increase. Orissa was the leading supplier, followed by Karnataka, Madhya Pradesh, and Maharashtra. According to the latest count, there were 278 operating manganese mines in 1979.

Production by the public sector Manganese Ore India, Ltd. (MOIL), the leading Indian producer of high-grade ore, rose 3% to 450,000 tons in fiscal year 1980-81. A major share of the company's ore was consumed by the ferromanganese and steel industries. To increase production and improve recovery of manganese, plans have been made to construct beneficiation and agglomeration plants near MOIL's Balaghat and Ukwa Mines. Ore samples have been sent overseas for testing. A 60,000-ton-per-year ferromanganese plant was also proposed for Balaghat. MOIL has contracted with domestic consultants to prepare feasibility reports for an electrolytic manganese dioxide plant and an electrolytic manganese metal plant. MOIL has begun manganese exploration in Orissa where efforts were being made to locate high-grade low-phosphorous ore. Such ore would be used to blend with low-grade high-phosphorous ore in an effort to stretch existing reserves. The fiscal year 1981-82 budget was to provide $16.25 million for MOIL's development programs.

The domestic requirement for manganese ore was in the neighborhood of 1 million tons annually, 60% of which was high-grade ore (plus 48% Mn content). The major consumers were ferromanganese, 47%, and steel industries, 35%. Requirements of steel plants were expected to rise from about 0.4 million tons in fiscal year 1980-81 to 0.75 million tons in fiscal year 1984-85 and to 1.0 million tons by the end of the decade following expansion of the indigenous steelmaking capacity. By then, total domestic demand for manganese ore was projected to reach 2.0 million tons, or double the present level.

With the domestic demand anticipated to rise and reserves presently estimated at about 80 million tons, the Government has cautiously restricted exports to low-grade ore. In fiscal year 1980-81 exports of manganese ore were 653,000 tons worth $18.1 million compared with 672,000 tons worth $17.4 million exported in fiscal year 1979-80. The fall in exports was due mainly to reduced liftings by Japan, which remained India's principal customer (75% of total).

Other Metals.—The Government announced the production of crude tellurium for the first time in India from a 20-kilogram-per-month pilot plant at HCL's Ghatsila smelter in Bihar. Tellurium was being recovered from anode slimes generated during the copper refining process. The crude metal will be refined at the Department of Atomic Energy's Special Materials plant at Bhaba Atomic Research Center. Based on the pilot plant operation, HCL has prepared a feasibility report for a commercial-scale 1,500-kilogram-per-year plant to be installed at Ghatsila.[13]

Part of the Centennial celebration of the Kolar Goldfield consisted of the inauguration of a scheelite recovery plant at the mines. Tungsten concentrate will be obtained from both the run-of-mine gold ore and the sizable reserve of old tailing sands. The plant will produce a 63% WO_3 concentrate with a rather low recovery of 32% of the tungsten present. Hutti Gold Mines Co., Ltd., was also investigating the possibility of recovering the scheelite values from its ores.

Most of India's small tungsten production has come from the Degana wolframite deposit in Nagour District of Rajasthan where mining and sorting were done manually. The deposit was being studied in detail with a view toward increasing output.

In addition, the Government was evaluating wolframite deposits in Sirohi (24°53'N, 72°52'E), Rajasthan; Agargaon (21°06'N, 79°29'E), Maharashtra; and Almora, Uttar Pradesh. Indian press reports state that the Sirohi deposit was very promising but reserves were not yet totaled.

A minable deposit of vanadium mineralization at Khursipur (21°23'N, 90°18'E), Ma-

harashtra, containing an estimated 6.3 million tons of 0.9% to 1.0% V_2O_5 was being investigated for the possibility of supporting a ferrovanadium plant. The size of the plant would probably be around 500 tons per year of ferrovanadium with a byproduct production of 50,000 tons per year of pig iron. Most of the output would be for export.

Meanwhile, the proposed ferrovanadium plant for Orissa remained in the planning stage. The latest proposal was by the Finnish firm Outokumpu Oy to set up a 400- to 500-ton ferrovanadium plant at Rairangpur, Mayurbhanj District, based on minable ore reserves (1.0% V_2O_5 cutoff) of 1.2 million tons at Kumardhubi (22°17'N, 86°19'E) and 0.8 million at Betjharan (22°16'N, 86°19'E).

NONMETALS

Barite.—Production, keyed primarily to exports, declined significantly in 1980. Minehead value was placed at $2.5 million. Cuddapah District of Andhra Pradesh, with around 65 million tons of reserves, accounted for over 90% of the country's production. India ranked fourth in world production in 1980.

Despite a worldwide increase in oil exploration and drilling, exports of Indian barite, both lump and powder, dropped from 340,000 tons in fiscal year 1979-80 to about 284,000 tons in fiscal year 1980-81. The decline was attributed to disruption in shipments to Iraq resulting from the Iraqi-Iranian conflict, Indian port congestion, and the uncertainty among foreign buyers regarding India's future barite export policy. On May 17, 1980, the Government announced that the private sector could undertake once again the export of barite, which had been restricted exclusively to the MMTC since April 1979. Exports to Mexico and Iraq, which were on a government-to-government basis, continued to be handled solely by MMTC. The United States, which imported about 90,000 tons, was the largest buyer; Mexico received 50,000 tons; and the Persian Gulf countries, primarily the United Arab Emirates and Saudi Arabia, got a total of 80,000 tons.

The Government revised floor prices for drilling-grade barite effective January 1, 1981, and valid through June 30, 1981. Barite powder was fixed at $67 per ton, a $2-per-ton increase, and $42 per ton for lump ore, a $2-per-ton decrease. Paint-grade prices were set at $138 to $162 per ton depending on the whiteness.

The Andhra Pradesh Mining Corp. principal mine at Mangampet can produce about 560 tons per day. Plans called for this to be increased to 1,000 tons per day within the next 2 years. About 70% to 80% of the run-of-mine production was marketable ore with the remainder being stockpiled until the company management can economically justify installing beneficiation facilities. The operation was being studied with this in mind.

Cement.—Despite an ambitious program of plant expansions and new construction, the supply of cement fell far short of the Indian requirements during 1980. Indian production rose modestly in fiscal year 1980-81 after a serious drop in fiscal year 1979-80 caused by acute shortages of coal and electric power. Unlike many of India's more important mineral based industries, the cement industry was mostly in the private sector, 85% of the total capacity. Owing largely to continuing coal shortages, capacity utilization declined to 67% in fiscal year 1980-81 compared with nearly 73% in the previous year. Cement plants in the south, especially in Karnataka, were most severely affected.[14]

The cement shortfall was met by high-priced imports. During fiscal year 1980-81, imports rose by 500,000 tons and were valued at about $150 million. Principal suppliers included the Republic of Korea, the Philippines, Indonesia, and North Korea. Imports were projected to reach 2 million tons valued at $188 million in fiscal year 1981-82 and rise to around 2.5 million tons in fiscal year 1982-83.

Because of the sizable gap between supply and demand, steps were being taken to increase output as well as the quality of cement. An interministerial working group reportedly has recommended liberalized licensing of new capacity, adoption of better technology—conversion to dry process or precalcination—provision for special foreign exchange allocation for imports of critical components, and improving power and coal supplies.

In addition, public sector units have been assigned a major program of utilizing slag from steel plants. The Uttar Pradesh Cement Corp. proposed a 1.68-million-ton-per-year plant at Chunar based on slag from the Bokaro steel plant. SAIL was also setting up a 2-million-ton-per-year cement plant at Chilahati based on Rourkela and Bhilai slag.

Total installed capacity of the cement industry in March 1980 was listed as 24.29 million tons from 57 units. The anticipated

growth in production capacity from cement plants both planned and under construction is shown as follows, in million tons:

Fiscal year	Capacity at start of year	Capacity added		
		Public sector	Private sector	Total
1980-81	24.29	2.24	[1]1.32	3.56
1981-82	27.85	.84	2.29	3.13
1982-83	30.98	.55	4.76	5.31
1983-84	36.29	1.40	2.65	4.05
1984-85	40.34	2.40	3.54	5.94
Total		7.43	14.56	21.99

[1]Includes 0.26 ton from joint ownership.

Successful completion of the ambitious expansion program will require a huge influx of capital funds plus substantial additional investment in the infrastructure to assure a smooth flow of cement to the consumer.

Expected demand for cement at the end of fiscal year 1984-85 was put at about 38 million tons. If the projected plant capacity produced at the planned 85% utilization factor, the new construction would be sufficient to put India into a position of slight cement surplus during 1985.

Diamond and Gem Stones.—Fiscal year 1980-81 export earnings from diamonds and jewelry rose 8% to $808 million from $749 million in the previous year. About 93% of this value was represented by cut and polished diamonds. The industry was helped by an increased demand for small diamonds (1/2 carat or less) from the United States where the import duty on small diamonds was withdrawn. Diamond exports were targeted at about $963 million for fiscal year 1981-82.

The export trade remained dependent on imports of rough diamonds, which cost India about $500 million in fiscal year 1980-81, up from $475 million in fiscal year 1979-80. Belgium and the United Kingdom supplied over 90% of the rough stones in 1980. The MMTC has been attempting to procure rough stones on a government-to-government basis from Ghana, Zaire, Central Africa, and Sierra Leone.

Domestic production of diamonds remained relatively insignificant. During 1980, over 14,000 carats were recovered from the Majhgawan Mine in Panna District of Madhya Pradesh. About 50% of the output was classed as gem quality. Workings at India's only other diamond mine, Ramkheri, were closed down during 1980 but processing of gravel stockpiles continued through July 1980.

The Government has drawn up a 3-year diamond exploration program for the Kalyandurg-Wajrakarus-Jonnagiri belt in Andhra Pradesh, the Panna diamond belt in Madhya Pradesh, and the Jungel area of Uttar Pradesh. The main purpose of the $31 million program was to establish the incidence of diamonds in different host rocks, to locate primary sources of diamonds and to evaluate the commercial viability of these occurrences. The Geological Survey of India was to act as coordinating agency with MEC and NMDC assisting in excavation and treatment of material.

The Geological Survey of India was studying the schists and pegmatites in the Teckhi-Khera area, Udaipur District, Rajasthan, for occurrences of emerald-bearing zones. It was also proposed to initiate investigation for semiprecious stones in Kanyakumari District, Tamil Nadu, and for agate in Kutch District, Gujart.[15]

Fertilizer.—To augment a steadily declining phosphate rock production, India was forced to import about 1.35 million tons in 1980, primarily from Jordan, the United States, Morocco, and Senegal. Production of rock phosphate by Rajasthan State Mines and Minerals, Ltd., at its Jamar Kotra deposit (65 million tons of reserves) was around 300,000 tons of more than 31% P_2O_5 in fiscal year 1980-81. The production was unlikely to change in fiscal year 1981-82, but plans called for raising the output of this mine to 1.0 million tons in the next 4 or 5 years. A 200-ton-per-day pilot plant for beneficiating 14% to 20% P_2O_5 content ore to 35% was to be commissioned in July 1981. By January 1982, if the pilot plant performs as designed, a 4,000-ton-per-day commercial-scale plant will be built.

Phosphate fertilizer production (P_2O_5 content) rose over 10% to 841,000 tons in fiscal year 1980-81. Improved operation of the Tuticorin plant, the addition of two new single superphosphate plants in the private sector, and a slight overall improvement in capacity utilization contributed to the higher output. In contrast, production of nitrogenous fertilizer during fiscal year 1980-81 declined marginally despite a 22% increase in the annual capacity to 4.73 million tons (nitrogen content). At the same time, capacity utilization also fell to 45% in fiscal year 1980-81 from 57% in the previous year. A shortage of naphtha feedstock, student and labor problems, and the chronic electric

power shortage were the main causes of the poor performance.

Two coal-based nitrogen fertilizer plants, Ramagundam in Andhra Pradesh and Talcher in Orissa, each with a capacity of 900 tons of ammonia and 1,500 tons of urea per day, began commercial production in November 1980. The plants reportedly cost $280 million each. Early reports indicated they had not achieved a very high level of efficiency by March 1981.

According to the Government, Haldia and Trombay V projects in the public sector, Gujart Narmada Valley Fertilizers Co. and Kanpur expansion in the private sector, and Kandla expansion in the co-op sector were expected to commence operating in fiscal year 1981-82. The country's total annual capacity would then be 5.3 million tons of nitrogen and 1.5 million tons of P_2O_5 by yearend 1981.

Fertilizer consumption during fiscal year 1980-81 increased over 6% to 5.58 million tons and was projected to rise to 6.6 million tons in fiscal year 1981-82 comprising 4.40 million tons of nitrogen, 1.47 million tons of P_2O_5, and 0.73 million tons of K_2O. This projected demand compared with an anticipated production of 3.0 million tons of nitrogen and 0.925 million tons of P_2O_5. There was no K_2O production in India. The shortfalls on each type would be met by imports.

The sixth 5-year plan (1980-85) proposed an outlay of $2.63 billion for setting up 8 new nitrogen and 11 new P_2O_5 plants. The eight nitrogen plants were in addition to the two natural gas based projects scheduled for Thal-Vaishet near Bombay and Hazira in Gujarat. Six of the eight are to be based on the natural gas from the Bassein Field, and one each on naphtha and coal. Of the 11 planned phosphatic fertilizer plants, an expansion of the Tuticorin plant was already underway and a new plant at Paradip costing $238 million was expected to be started in 1981.

Planning and financing for the new ammonia plants at Hazira and Thal-Vaishet continued during 1980. Preliminary development of infrastructure and site preparation also got underway in 1980. These plants will be the first based on the large offshore reserves of the Bassein Gasfield.

Hazira project was estimated to cost over $1.2 billion and would produce 2,700 tons per day of ammonia from two similar production lines. Downstream urea facilities will have an output of 4,400 tons per day from four 1,100-ton-per-day production lines. Pullman Kellogg of the United Kingdom was to provide the ammonia technology and Snam Progetti SpA of Italy the urea know-how.

An ammonia plant of similar capacity was also taking shape in 1980 at Thal-Vaishet. Project delays on this plant have been costly to the Indian Government. Since the original estimates in 1978, costs have nearly doubled to $1.1 billion. Haldor Topsoe of Denmark was to supply the ammonia technology. Snam Progetti will install three urea production lines of 1,500 tons per day each.

Limestone.—Limestone production in India dropped slightly during 1980 owing to less offtake by user industries. Limestone accounted for nearly one-half of the total value of output of nonmetallic minerals, about $84 million in 1980. Andhra Pradesh, Bihar, Gujart, Karnataka, Madhya Pradesh, and Tamil Nadu, which possess most of the country's reserves, accounted for over 70% of the production. Current reserves are in the neighborhood of 70,000 million tons with 6,300 million tons proved, 4,500 million tons indicated, and 59,200 million tons inferred. Roughly three-fourths of these reserves were cement grade and were widely dispersed. Over 60% of the production originated at captive mines of cement plants. The concentration of the cement industry in southern and western India was a reflection of plants being set up near the most suitable limestone deposits. The Government's recent policy of encouraging the construction of large new cement plants and the establishment of numerous mini cement plants throughout the country was going to increase overall limestone production considerably and expand the exploitation of smaller deposits of cement-grade limestone.

Chemical-grade limestone reserves were confined to Gujarat State and flux-grade limestone, to Orissa and Madhya Pradesh. In addition to cement, industrial users of limestone included those producing iron and steel, fertilizers, refractories, asbestos, ferromanganese, and sugar. Almost all of India's production of limestone was consumed within the country. Only small quantities were exported to the neighboring countries of Bangladesh, Nepal, and Sri Lanka.

Mica.—The increased demand for fabricated mica or mica-based products has spurred a new official policy of encouraging the development of value added mica-based

products. Accordingly, the Government's Mica Trading Corp. (MITCO) was planning to set up (1) a micronized mica powder plant at a cost of $0.5 million to produce 3,000 tons per year of mica powder, (2) a mica paper plant involving investment of $27.5 million for producing 1,200 tons of paper with 50% based on the mechanized disintegration process and 50% on the thermochemical process, (3) a mica paper-based products plant with capital outlay of $4.5 million, (4) a wet ground mica powder plant at a cost of $1.6 million to produce 1,200 tons per year, and(5) a glass bonded mica plant at a cost of $1.5 million. Final arrangments for technical collaboration were yet to be made for some of the above plants. Most of the plants would require foreign know-how to some extent.

In addition, a mica capacitor plant was to be set up in the joint sector with the public sector Bihar State Electronics Development Corp. having a 26% share in the $662,000 cost. The entire output of the plant was to be exported. Negotiations were reportedly going on with some U.S. firms for a technical collaboration.

The declining trend in the production of mica that set in a decade ago continued into 1980. The official statistics, however, were lower than the actual production as substantial quantities come from existing stockpiles or are simply unreported to avoid taxation and royalties. Regardless of the production trend, India was by far the major producer of natural sheet mica, accounting for nearly 85% of the world's total in 1980.

Mica mining, almost entirely in the private sector, continued to be a traditional cottage-type industry operating mostly in Bihar, Andhra Pradesh, and Rajasthan. Bihar produced 60% of the production by value and had 151 of the 251 reporting mica mines in 1979.

Despite the private ownership, the Government extended considerable control over the industry and through MITCO controlled prices and shared with the private sector all exports of crude and processed mica on an equal 50:50 basis. Mica export earnings increased from $23.4 million in 1979 to $28.1 million in 1980. By far the greatest proportion of the exports were in the form of relatively low value scrap mica. The block mica accounted for only 6% of total export tonnage but made up 68% of the total value.

Mineral Sands.—Production of titanium and heavy beach sand minerals by the public sector Indian Rare Earths, Ltd., (IREL), registered some impressive gains during 1980. Value of production, however, remained at around $11 million for the year. Most of the monazite production, which contains about 10% ThO_2, came from IREL's mineral sands project at Manavalakurichi, Tamil Nadu. The installation of a preconcentrator at Manavalakurichi and the modernization of IREL's Chavara plant near Quilon, Kerala, was reflected in the higher production statistics and in higher production targets for 1981. In addition to the monazite, these beach sands yield ilmenite, rutile, zircon, garnet, and sillimanite. Processing of the monazite yields exportable amounts of rare-earth chloride, fluoride, and oxide and trisodium phosphate. The thorium hydroxide was stockpiled for possible future use. Through its research efforts, IREL has been able to recover samarium, gadolinium, and yttrium, which could be added to the export list as production improves.

Completion of the $100 million (first phase) Orissa mineral sands complex was set for yearend 1982 following several delays and reschedulings. The plant will have an annual capacity of 220,000 tons of ilmenite (50% TiO_2) to be processed into 100,000 tons of synthetic rutile (90% TiO_2), 30,000 tons of sillimanite, 2,000 tons of zircon, 4,000 tons of monazite, and 10,000 tons of natural rutile (95% to 97% TiO_2). Based on this planned output, IREL was looking for foreign collaboration in setting up a titanium sponge plant or titanium pigment plant.

IREL's Chavara plant was scheduled to receive magnetic separation equipment to further improve its ore recovery operation. To meet shortages of titanium dioxide pigment in India, Kerala Minerals and Metals, Ltd., was going to set up a 25,000-ton-per-year plant near Quilon, which was to be completed in late 1982. Kerr McKee Co. of the United States was reportedly providing the process technology.[16]

MINERAL FUELS

Coal.—Indian coal reserves at 112 billion tons are the fifth largest in the world (based on maximum depth of 1,200 meters and minimum thickness of 1/2 meter). About one-eighth of these reserves is considered to be of metallurgical grade. Owing to the high ash and moisture content, most Indian coal is considered poor in quality. Nevertheless, in view of the vast coal reserves and rising petroleum import bill, which exceeded $6.5 billion in 1980-81, coal remained the coun-

try's primary energy resource.

The Geological Survey of India and MEC continued their exploration programs to upgrade existing reserves and establish new ones. Press reports indicated major new finds in the north Karanpura coal belt under Central Coalfields, Ltd.

Based on recent geophysical and core drilling activities, Gujarat State has established coal reserves of over 60 billion tons at depths between 1,300 and 1,800 meters. Random testing indicated that compared with most other Indian coal, the deposits were of unusually good quality—2% to 3% ash, 4% to 5% moisture, 50% volatiles, 42% to 50% fixed carbon, and 6,500 kilocalories per kilogram heating value. Because of the excessive depth and presence of several high-pressure gas- and oil-bearing horizons (present source of oil and gas production) overlying these coalbeds, the State Government was investigating the possible application of in situ coal gasification technology to exploit these reserves. It would be extremely difficult to exploit these deposits economically using conventional mining methods. Exploration of these deposits was continuing.

Following 5 years of relatively little change in coal output, fiscal year 1980-81 production reached a record level. Production of Coal India Ltd.'s (CIL), five subsidiaries came to nearly 101 million tons, or nearly 88% of India's total coal output. The other coal producers also increased their output during the year.

The major increase in production came from mechanized open pit mines, which accounted for 35% of production, up from 28% in 1979-80. CIL's share from open pit mines was reported to be even higher. Output per employee shift, which had been nearly static for the last 5 years at 0.66 ton, rose to 0.71 ton in fiscal year 1980-81.

The sharp increase in total coal production resulted in raising pithead coal stocks by 4.5 million tons to 18.5 million tons in fiscal year 1980-81. Inadequate supply of high-quality coal and railroad transport bottlenecks, however, continued to affect production of many major industries including fertilizer, cement, and paper. Continued shortages of metallurgical coal also restricted steel production as coking coal output increased only marginally. India was forced to continue importing high-grade coking coal to blend with the domestic output. The continued overall inferior quality of coal being delivered hampered boiler efficiency and created maintenance problems for end users and the added burden of higher handling and freight costs.

Despite higher costs, movement of coal by road transport since 1977-78 has risen by 73%, whereas the movement by rail during the same period declined by 9%. Rail transport reportedly picked up sharply during the fourth quarter of fiscal year 1980-81.

In light of the continuing problems relating to the coal sector, several proposals were being considered by the Government of India to improve decision making and increase coal output. Reorganization of CIL was being considered but no decision had been reached by yearend 1980.

New technologies to increase production as well as to eliminate wasteful mining practices were under review. In addition to modernizing production methods, several captive electric powerplants were planned for the mining areas. In recent years, one of the main production constraints in the underground mines was the shortage of electric power, which caused severe mine dewatering and ventilation problems.

A major component of the development strategy was a gradual shift to more open pit mining. Fiscal year 1984-85 open pit operations were expected to account for 71 million tons or about 43% of coal produced and raise to over 50% by fiscal year 1989-90 compared with the present 35% share.

By fiscal year 1984-85, longwall mining was to contribute 10 to 13 million tons, compared with the present 2.5 million tons. Only about 20% of Indian coal was estimated to be recoverable by open pit mining; therefore, development of longwall and other modern underground mining technology was critical in the long-term overall coal production plan.

Research and development efforts were being stepped up to improve the quality of coal shipped to consumers. Construction of five new coal washeries with a throughput capacity of nearly 9 million tons of raw coal was planned. These would expand the present washery capacity from 27.8 million tons to 36.5 million tons by fiscal year 1984-85 at a reported cost of $31 million. Introduction of simple methods of upgrading noncoking coal to ensure a consistent quality of feed to powerplants was being considered. The Central Coal Research Institute was engaged in developing fluid-bed combustion technology to offset the rising ash content of Indian coal.

In an effort to offset the $144 million financial loss of CIL in fiscal year 1979-80, the price of coal was increased an average of $2.50 per ton in February 1981. CIL's mine-head coal prices, after the increase, ranged from $12 to $17 depending on location and grade. CIL's financial position for fiscal year 1980-81 was not available.[17]

Lignite.—Neyveli Lignite Corp. in Tamil Nadu mined about 4.6 million tons of lignite in fiscal year 1980-81 and was by far the major producer in India. The company's plan was to raise lignite production at its first open pit mine cut to 5.8 million tons in fiscal year 1981-82, to 6.5 million tons in fiscal year 1982-83, and ultimately to 8.5 million tons per year. Proposed expenditures for fiscal year 1981-82 were put at $140 million. Work was progressing on the second mine cut, which would initially produce 4.7 million tons of lignite per year. The Federal Republic of Germany was helping to finance the development work.

Virtually all of the lignite goes to the generation of electric power or the production of nitrogen fertilizer. Output of the second mine cut will feed a 630-megawatt onsite powerplant. Ultimate capacity of the second mine would be 10 million tons per year and power a 1,470-megawatt plant still on the drawing boards. The feasibility of a third mine cut, to produce 10.5 million tons per year to support a 1,500-megawatt powerplant by 1995, was also being studied.

Aside from Tamil Nadu, lignite resources were also being developed in Gujarat to help meet the State's massive electric power expansion program. Expansion of present lignite mining operations were called for by the Gujarat Mineral Development Corp. to meet the demand of 2,000 tons per day in support of a 110-megawatt powerplant being set up by the State Electricity Board. The goal was to eventually produce 4,000 to 5,000 tons of lignite per day. The possible production of lignite in Rajasthan was also being studied.

Natural Gas.—Overall gas production declined substantially because much of the flow originates as associated gas from the Assam crude oil production. A major increase in production came from offshore BH which increased production from 386 million cubic meters in fiscal year 1978-79 to 673 million cubic meters in fiscal year 1980-81.

Plans called for the eventual doubling of the Uran gas fractionation plant capacity as natural gas production increases. First phase development of the 300-billion-cubic-meter (10.5-trillion-cubic-foot) Bassein South Gasfield was about to get underway. Under Phase I, gas production was to reach 10 million cubic meters per day by the end of 1984. This would be raised to 18 to 20 million cubic meters per day in the Phase II development. Two well platforms would be needed plus a 236-kilometer subsea pipeline to link the field with onshore processing facilities in Gujarat. The gas processing yielded about 150,000 tons per year of liquefied petroleum gas (LPG) plus a small amount of heavier condensate. The Government Oil and Natural Gas Commission (ONGC) was also considering exploiting a smaller gasfield discovered on the Tapti structure in the Gulf of Cambay. The recent discoveries of gas off Porto Novo and the Andaman Islands have not been sufficiently drilled to define whether they could be economically developed.

Oil.—Despite an increase in offshore crude oil production during fiscal year 1980-81, India's crude oil output fell substantially. This decline was attributed to prolonged student agitation in northeast India, which crippled petroleum operations in that region. The result was higher imports of refined products that, coupled with increased crude oil prices, produced a record POL import bill estimated at close to $7 billion in contrast to $4 billion in fiscal year 1979-80. Imports in fiscal year 1980-81 included 16.25 million tons of crude oil and 7.05 million tons of refined products compared with 16.12 million tons of crude and 4.78 million tons of refined products in the previous year. Despite some disruption in supplies as a result of the Iraqi-Iranian hostilities, these countries plus Saudi Arabia, the United Arab Emirates, and the U.S.S.R. remained India's principal crude oil suppliers in 1980.[18]

India firmed up its crude oil requirements for 1981 on a government-to-government basis. These arrangements called for 17 to 18 million tons, which should provide some surplus as well as some built-in flexibility. Several nontraditional suppliers including Algeria, Mexico, Libya, and Venezuela have offered crude for the first time in 1981. However, unless some swapping arrangement could be worked out, India was likely to reject most of these offers owing to the high freight costs and difficulty of refining crude from these countries.

In order to lower petroleum imports, the costs of which are causing an increasingly

serious burden on the entire Indian economy, the Government has undertaken an urgent program to step up oil exploration and development with emphasis on the more promising offshore areas. The sixth 5-year plan has earmarked $3.6 billion for oil exploration and development but this figure now appears to be unrealistically low. Estimates for developing the full potential of the Bombay High and satellite fields and expanding refinery, petrochemical, and fertilizer facilities come to nearly $8 billion.

ONGC deployed onshore 32 seismic parties, 12 geological field parties, and 5 gravity-magnetic survey parties during 1980. About 32 drilling rigs deployed mainly in the eastern and western regions completed 47 exploratory and 36 development wells in 1980 for a total of 155,000 meters. The drilling level was below target because of the student agitation in Assam. Eight new structures were drilled during the year resulting in the discovery of new oil reserves and a new gas structure at Dehej in Ankleswar Oilfield in Gujarat.

ONGC's onshore drilling program in fiscal year 1981-82 called for completion of 102 wells totaling 238,000 meters and covering both the eastern and western regions. Under an Indian-Soviet agreement, the Soviets were to explore and develop one or two onshore oil and gas deposits on a turn-key basis in Tripura and West Bengal. They will also help in secondary recovery operations in the northeast oilfields. A Canadian group was to assist in improving production from some of the Gujarat wells in western India.

ONGC's offshore survey work totaled 22,600 line kilometers in the 1980 survey season, and another 21,000 line kilometers were scheduled for 1982.

Offshore drilling work in fiscal year 1980-81 totaled 14 exploratory and 20 development wells conducted by 6 rigs. One was the Indian-owned jackup Sagar Samrat, and the remainder were on charter from the United States and Norway. India was to take delivery of its second jackup rig, the Sagar Vikas, from Japan in March 1981. The French-built Sagar Pragati was scheduled for delivery shortly thereafter, and two more jackups were under construction in Singapore. Additional purchases were being made or planned.

During 1980, five new offshore structures were drilled leading to discovery of hydrocarbons at Godavari, Ratnagiri, the Andaman Islands, and Porto Novo. Except for Ratnagiri, the discoveries were found on the east coast for the first time. As of March 1981, ONGC had drilled a total of 91 offshore exploratory and assessment wells of which only 35 have proven to be dry, reflecting a remarkably high rate of success.

The ONGC planned to drill 20 exploratory and 39 development wells during fiscal year 1981-82. Further exploration was called for in the Krishna-Godavari Basin where there are numerous structures with at least eight located in water depths beyond the 200-meter shelf limit. Owing to physical conditions in the Godavari Basin such as relatively strong surface currents, a soft sea bottom, and greater depths, the deeper areas may now be turned over to foreign companies on a production sharing basis for exploration if contract conditions can be agreed on. During 1980 three wells were drilled in this basin but all had to be abandoned following loss of two blowout-preventers and some casing.

Oil India Limited (OIL), a joint 50:50 venture by the Government of India and Burmah Oil, Ltd., of the United Kingdom, until recently confined its operations to onshore exploration in the northeastern States. During 1980, OIL drilled 12 onshore wells and for the first time 2 offshore wells off the coast of Orissa. Five of the 12 onshore wells were drilled in the Kharsang area of Arunachal Pradesh and yielded new oil discoveries. The find was considered very promising and will probably be put into commercial production. Oil was also found in the Bagapani area of Assam. Thirty more exploration wells were planned for the next 3 years on the basis of these discoveries.

In addition to its onshore drilling, OIL spudded two offshore wells in the Mahanadi Basin that were judged noncommercial. Additional wells were planned when a drill rig becomes available.

OIL's crude production was severely curtailed by unrest in Assam but was returning to normal after the situation quieted. Natural gas production was scheduled to nearly double during 1981. OIL was having a 60,000-ton-per-year LPG plant built in Assam that will also produce 12,000 tons of condensate per year. The project would annually save over $19 million in foreign exchange by replacing 70,000 tons per year of kerosine imports. Scheduled completion was for 1982.

Negotiations for the 100% takeover of OIL by the Indian Government continued, with indications that an agreement would be reached in 1981. India was also expected

to take over the Assam Oil Co. in the near future.

Crude oil production from offshore BH oilfield continued to show improvement in 1980 averaging nearly 100,000 barrels per day from 19 platforms, 11 of which were installed during 1980. The rate of production was to be stepped up to 180,000 barrels per day by October 1981 and later to 225,000 barrels per day. These production increases will call for 10 more well platforms as part of Phase IV and V development made possible by the recent installation of the $90 million, 180,000-barrel-per-day processing-pumping platform installed by J. Ray McDermott and Co. of the United States. A second 180,000-barrel-per-day processing-pumping platform was scheduled for BH by mid-1982. This $190 million project will serve the southern part of BH. Other fields near BH will also be developed as funding and equipment permit. By 1985, with the development of several satellite structures, offshore crude oil production could possibly exceed 400,000 barrels per day (20 million tons per year).

Consumption of refined products increased 3.6% to 31 million tons in fiscal year 1980-81. This compared with a 4.6% rise in fiscal year 1979-80 and 10.6% in fiscal year 1978-79. This deceleration in the consumption growth rate was attributed largely to retail price increases levied in June 1980 and January 1981 to offset the sharp increase in the cost of imported petroleum. Indian pattern of consumption in recent years was as follows in thousands of tons:

Product	1978-79	1979-80	1980-81
Diesel oil	9,854	10,940	10,326
Furnace oil	4,395	4,582	5,336
Kerosine	3,952	3,867	4,200
LPG	408	405	394
Gasoline	1,499	1,480	1,521
Naphtha	2,515	2,429	2,324
ATF	1,154	1,140	1,128
Bitumen	943	1,072	1,081
Petroleum coke	155	173	100

Based on the April 1, 1981, commissioning of a gas fractionation plant for production of 150,000 tons per year of LPG at Uran, two refineries in Bombay have already built bottling plants for LPG distribution. Once the Uran plant is operating, consumption of kerosine should decline as consumers switch to LPG. Over the next 30 months, gas connections for about 3 million new customers were likely to be approved. This should further lower the kerosine consumption.

The Indian Government's projected consumption of refined products for fiscal year 1981-82 was between 33 million and 35 million tons, 45.5 million in 1985, and 62 million by 1990. Even if the estimates are on the high side, such demands would be beyond India's financial capabilities. The Government was thus examining various options and methods of conservation, conversion, and pricing mechanisms to lower the rate of consumption increase.

Refining was almost entirely in the public sector. The one exception was the 0.5-million-ton-per-year Digboi refinery operated by Assam Oil Co., which was owned by Burmah Oil of the United Kingdom. Refinery throughput in 1980 declined because of the intermittent closing of the refineries in the northeast due to the student unrest. The fiscal year 1981-82 crude throughput target was set at 32.25 million tons, a nearly 25% increase over that of 1980. The target was feasible with the normal functioning of the northeast refineries and the commissioning of part of the 6-million-ton capacity of the Mathura refinery.

To meet the anticipated growth in consumption of refined products, the country was embarking on a major refinery expansion program that will raise India's refining capacity from 31.8 million tons per year to around 45 million tons per year by 1985, including (1) doubling the annual capacity of Madras refinery to 5.6 million tons, (2) expanding Visakhapatnam refinery from 1.5 million to 4.5 million tons per year, and (3) upgrading the Cochin refinery from 200,000 tons to 3.5 million tons per year. Also under consideration was a 6-million-ton-per-year plant at Mangalore and a 3-million-ton-per-year plant at Karnal (29°41'N, 76°59'E) in Haryana. Secondary processing facilities to increase the output of middle distillates were also proposed for a number of refineries.

The Government was developing pipelines for petroleum distribution to reduce the burden on the railroad system. A 532-kilometer product pipeline was under construction in two segments, Mathura-Delhi and Delhi-Ambala-Jullunder. The first section was scheduled for completion by August 1981 and the second by April 1982. Several other projects including modernization and looping of existing lines will help to upgrade the overall distribution system.

[1]Physical scientist, Branch of Foreign Data.
[2]Regional resources attache, U.S. Department of State, New Delhi, India.

[3]The Indian fiscal year runs from Apr. 1 to Mar. 31.

[4]Where necessary, values have been converted from Indian rupees (Rs) to U.S. dollars at the rate of Rs8.20=US$1.00 in 1978 and 1979, and Rs8.00=US$1.00 in 1980.

[5]U.S. Embassy, New Delhi, India. Department of State Airgram A-35, May 19, 1981, p. 2.

[6]Iron and Steel Review. Calcutta, India, v. 24, No. 6, November 1980, p. 2.

[7]U.S. Embassy, New Delhi, India. Department of State Airgram A-49 (draft), July 6, 1981, pp. 1-52.

[8]Government of India. Ministry of Steel and Mines, Department of Mines. Report 1980-81, New Delhi, pp. 52-65.

[9]Mining Journal, London. V. 296, No. 7591, Feb. 13, 1981, p. 115.

[10]The New Sketch. Dhanbad, India, v. 40, No. 32, May 12, 1980, p. 23.

[11]Government of India. Ministry of Steel and Mines, Department of Steel, Report 1980-81, New Delhi, pp. 21-69.

[12]Work cited in footnote 9, pp. 73-77.

[13]U.S. Embassy, New Delhi, India. Department of State Airgram A-32, Apr. 30, 1980, pp. 1-2.

[14]Fortnightly Journal of Industry and Commerce. New Delhi, India, v. 18, No. 9, May 1, 1981, pp. 2-40.

[15]Geological Survey of India News. Calcutta, India, v. 11, No. 3, March 1980, p. 4.

[16]Work cited in footnote 8, pp. 41-44.

[17]U.S. Embassy, New Delhi, India. Department of State Airgram A-31, May 22, 1981, pp. 1-16.

[18]U.S. Embassy, New Delhi, India. Department of State Airgram A-52 (draft), July 10, 1981, pp. 1-33.

The Mineral Industry of Indonesia

By John C. Wu[1]

In 1980, the second year of the 5-year development plan (1979-84), there was a significant improvement in Indonesia's real economic growth. In 1980, Indonesia's growth in real gross domestic product (GDP) was about 7.1% compared with 4.9% in 1979. The level of inflation came down to about 17.1% in 1980 from 30% in 1979. Indonesia's GDP in current price was $67,022 million in 1980 compared with $48,961 million (revised) in 1979.[2] A record high rice crop and favorable prices and production of crude oil, liquefied natural gas (LNG), tin, rubber, and timber were the major contributing factors to the overall growth of Indonesia's GDP in 1980. By sector, components of GDP during 1979-80 were[3] agriculture, 31%; industry (manufacturing), 10%; energy, mining and quarrying, 18%; construction, 5%; transportation and communication, 5%; and services and other, 31%.

The oil and gas sector continued to remain the most important industry. Indonesia was the world's 10th largest oil exporter in 1980. The industry's export earnings accounted for 73% of the estimated $23.3 billion of overall merchandise export earnings in 1980. This revenue from oil provides for about two-thirds of Government development expenditure. There was a new wave of oil and gas exploration as a result of an attractive new joint-venture contract and arrangement. Exploration was also intensified by a series of hikes in the price of oil and gas. More than 200 exploratory wells were drilled in 1980, numerous onshore and offshore oil and gas wells were discovered, a total of 11 oil and gas production-sharing contracts were signed, and a record high $591 million for oil exploration was committed by eight foreign oil companies. However, Indonesia's oil output continued to drop by 2% because of a noticeable slowdown in oil exploration activities during the 1975-77 period and the depletion of some old wells. Production of LNG by five liquefaction trains, which utilized natural gas from Arun Field of North Sumatra and Badak Field of East Kalimantan was at full capacity. A record high production of LNG was reached in 1980. Two LNG plants were scheduled to be completed by 1983, doubling the country's existing capacity. Indonesia's coal production continued to increase, and the expansion project of Bukit Asam was moving on schedule. A coal preparation plant for Ombilin Mine was scheduled to come onstream in 1981.

The nonfuel minerals sector remained as the fourth largest export earner after oil and gas, timber and wood products, and rubber. The continuing high price of tin and the operation of two new large offshore dredges (Bangka II and Bima) helped the country's tin production to reach a new record high since 1954. Indonesia was the world's fourth largest producer of tin in 1980. The $101.5 million expansion program of Freeport's Ertsberg East underground copper mine in Irian Jaya was ahead of schedule. A new manganese ore deposit in the Bima area of West Nusa Tenggara Island began production in 1980. Sarae Bure Port was being constructed to handle the exports of manganese ore to Taiwan and other countries. Work on P.T. Aneka Tambang's nickel operation on Gebe Island continued to progress. P.T. Inco had resolved problems at its Soroako plant to achieve 93% of planned nickel output for 1980. The $2 billion Asahan aluminum project was proceeding on schedule. The overall construction of the aluminum smelter and

two gigantic hydroelectric powerplants was about 50% completed. However, construction of an alumina plant, using the bauxite in the Tayan region of West Kalimantan remained uncertain.

Indonesia's cement industry continued to expand. In 1980, two new cement plants (Padang II and Tonassa II) were inaugurated. Indonesia's total cement capacity was increased to 7 million tons per year. However, owing to rapidly increasing demand for cement caused by the construction boom, net imports of cement totaled about 100,000 tons in 1980. In 1980, P.T. Pupuk Kujan's new urea plant in Java was inaugurated.

PRODUCTION

Production of oil and natural gas remained the dominant sector of Indonesia's mineral industry. In 1980, output of crude oil dropped slightly from 1.59 million barrels per day in 1979 to 1.56 million barrels per day in 1980. Output of natural gas remained at about 1 trillion cubic feet. Production of LNG increased substantially and reached over 8 million tons by yearend. Coal production increased moderately, and reached over the 300,000-ton level.

Output of tin reached a 25-year high of 32,527 tons in 1980, as a result of two additional, new large offshore dredges operating around Bangka and Tudju Islands. Bauxite production in 1980 was at a higher level than production of 1979. Nickel and copper production decreased slightly. Manganese ore production from the Java area remained at about 6,000 tons. A new manganese mine in Bima, with an estimated ore reserve of about 50 million tons, started production in 1980. About 15,000 tons of ore were produced by yearend for export to Taiwan, Japan, and the Republic of Korea. Gold and silver production in 1980 reversed the downward trend of the 1977-79 period as a result of increased mine output induced by higher prices.

The cement industry had expanded its total annual capacity from 5.9 million tons in 1979 to 7.0 million tons in 1980. A construction boom in Indonesia resulted in cement shortages in many areas of the country. Total industry capacity to produce chemical fertilizers was more than 2.8 million tons per year, most of which was nitrogenous fertilizer. Indonesia manufactures about 500,000 tons of phosphate and complex fertilizer using imported raw materials.

Table 1.—Indonesia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum: Bauxite, dry equivalent, gross weight thousand tons	940	1,301	1,008	1,052	1,249
Copper, mine output, metal content	69,070	[r]57,120	58,952	60,210	57,985
Gold metal[2] troy ounces	114,000	82,300	66,166	57,452	[e]59,400
Iron and steel:					
Iron sand, dry basis	292,334	311,519	233,341	79,877	74,743
Metal:					
Ferroalloys: Ferronickel	16,886	21,574	19,734	17,878	18,314
Crude steel	139,000	145,000	150,000	500,000	600,000
Manganese ore	9,833	5,976	5,889	5,909	NA
Nickel:					
Mine output, metal content[3]	28,772	33,083	31,414	38,195	30,749
Metallurgical products:					
Matte:					
Gross weight	--	--	--	8,721	20,532
Nickel content	--	--	--	6,715	15,810
Ferronickel:					
Gross weight	16,886	21,574	19,733	17,878	18,314
Nickel content	3,857	4,928	4,499	4,000	4,196
Silver, mine output, metal content thousand troy ounces	1,072	790	826	662	[e]680
Tin:					
Mine output, metal content	[r]23,435	25,926	27,411	29,535	32,527
Metal	23,322	24,005	25,829	27,790	30,465
NONMETALS					
Asbestos[e]	100	60	--	--	--
Cement, hydraulic thousand tons	1,804	[r]2,651	3,694	4,698	[e]5,878

See footnotes at end of table.

Table 1.—Indonesia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Clays:					
Kaolin powder	29,323	[r]38,006	37,400	58,539	[e]65,000
Other, for cement manufacture thousand tons	380	NA	NA	NA	NA
Diamond:					
Industrial[e] thousand carats	12	12	12	12	12
Gem[e] do	3	3	3	3	3
Total[e] do	15	15	15	15	15
Iodine kilograms	27,290	[r]11,930	7,253	25,287	[e]25,000
Nitrogen: N content of ammonia	184,910	410,463	584,655	759,600	721,800
Phosphate rock	7,565	[r]3,599	6,071	5,323	[e]5,000
Salt, all types thousand tons	[r]563	[r]786	235	706	[e]700
Stone:					
Granite do	804	[r]722	495	678	[e]700
Limestone[4] do	2,121	3,724	4,699	6,107	[e]7,000
Marble square meters	25,944	35,217	33,495	25,216	[e]30,000
Quartz	[r]221,441	269,310	307,480	127,082	[e]120,000
Sulfur, elemental[5]	3,483	1,697	204	180	[e]200
MINERAL FUELS AND RELATED MATERIALS					
Asphalt rock, bitumen content	104,990	137,701	162,000	91,000	173,016
Carbon black	1,715	974	NA	NA	NA
Coal thousand tons	183	231	264	279	304
Gas, natural:					
Gross million cubic feet	312,368	533,355	643,148	998,457	1,045,748
Marketed do	126,426	199,951	384,116	398,807	695,914
Natural gas liquids: Propane and butane[e] thousand 42-gallon barrels	70	70	11	15	NA
Petroleum:					
Crude, including field condensate do	550,319	615,123	596,698	601,236	536,969
Refinery products:					
Gasoline do	9,763	14,444	15,363	15,405	17,475
Jet fuel do	589	[r]622	--	59	25
Kerosine do	13,818	[r]19,948	19,187	24,217	25,988
Distillate fuel oil do	15,215	[r]19,384	18,345	18,735	19,184
Residual fuel oil do	8,036	[r]15,225	16,128	14,683	17,985
Lubricants do	14	24	264	544	499
Other:					
Liquefied petroleum gas do	291	299	373	72	294
Paraffin wax do	267	328	62	338	253
Naphtha do	1,835	100	1	1	([6])
Unfinished oils requiring further processing do	[r]31,304	[r]38,650	28,795	40,096	41,599
Unspecified do	[r]1,148	[r]577	1,420	3,172	2,418
Refinery fuel and losses do	[r]1,065	[r]2,958	2,887	3,159	3,917
Total do	83,345	[r]112,559	102,825	120,481	129,637

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 30, 1981.

[2]Includes Au content of copper ore and output by Government-controlled operations. Gold output by operators of so-called People's mines is not available but may be as much as 30,000 troy ounces per year.

[3]Includes a small amount of cobalt which is not recovered separately.

[4]Data represent limestone used for cement production. Excludes considerable amounts of limestone produced by enterprises under local jurisdictions for building materials, for crushed rock to be used as aggregate, and to burn for lime.

[5]Sulfur produced by other than the Frasch process.

[6]Less than 1/2 unit.

TRADE

Crude oil, LNG, rubber, and tin, along with timber and wood products remained the major export earners of Indonesia.

In 1980, exports of crude oil and LNG alone were estimated at $17 billion, about two-thirds of overall export earnings. Japan and the United States remained Indonesia's two biggest customers in 1980. Of a total of 378.5 million barrels of oil exported in 1980, Japan purchased a total of 206 million barrels, accounting for 54%, and the United States, purchased 113 million barrels, accounting for about 30%. Indonesia exported most of its LNG to Japan (7.5 million tons valued at over $1.5 billion in 1980) and to the United States. Nonoil minerals remained the fourth largest export earner. Export earnings of tin, up 23% to $461 million in

1980, accounted for about two-thirds of total nonoil mineral exports. Exports of bauxite, copper concentrate, and nickel ore and concentrate were mainly to Japan and the Federal Republic of Germany.

Indonesia imported about $15 billion of merchandise in 1980. Imports of machinery and electrical equipment, base metals, vegetable products, mineral products, chemical and allied products, and vehicles and transport equipment remained the top six import groups. Principal suppliers were Japan, the United States, and the European Communities.

Because of the sharp increase in export earnings, mainly from oil and gas, Indonesia's foreign exchange position improved greatly with more than $8 billion overall trade surplus.

Table 2.—Indonesia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate ___ thousand tons__	911	1,091	--	Japan 997; Netherlands 94.
Metal including alloys, all forms	77	202	--	Singapore 197.
Copper ore and concentrate	186,601	168,634	--	Japan 126,356; West Germany 42,278.
Iron and steel metal:				
Scrap	6,018	NA	NA	NA.
Ferroalloys	4,686			
Semimanufactures	7,721	123,690	--	Saudi Arabia 65,160; Malaysia 28,312.
Manganese ore and concentrate	88,528	1,770	--	Japan 1,570.
Nickel:				
Ore and concentrate	576,377	811,161	8,113	Japan 802,785; Netherlands 263.
Matte, speiss, similar materials	15,627	NA	NA	NA.
Tin:				
Ore and concentrate	976	1,624	--	Malaysia 1,074; Japan 550.
Metal including alloys:				
Scrap	676	475	--	Singapore 325; West Germany 150.
Unwrought	22,859	26,274	--	Singapore 8,537; Netherlands 6,430; Japan 5,700.
Semimanufactures ____ kilograms__	400	3,000	NA	NA.
Zinc:				
Oxides	80	NA	NA	NA.
Metal including alloys:				
Scrap	115	NA	NA	NA.
Unwrought and semimanufactures	253	NA	NA	NA.
Other:				
Ash and residue containing nonferrous metals	567	NA	NA	NA.
Metal including alloys, scrap	--	664	NA	Singapore 391.
NONMETALS				
Abrasives natural, n.e.s.: Pumice, emery, corundum, etc	23	NA	NA	NA.
Barite and witherite	12,546	NA	NA	NA.
Cement	36,700	488,217	--	Thailand 243,970; Bangladesh 94,528; Hong Kong 72,555.
Clays, crude:				
Bentonite	2,736	NA	NA	NA.
Kaolin	2,558	NA	NA	NA.
Other	49	NA	NA	NA.
Fertilizer materials:				
Manufactured, nitrogenous	243,952	233,030	--	Philippines 97,213; Malaysia 55,336; Bangladesh 42,008.
Ammonia	827	NA	NA	NA.
Precious and semiprecious stones, synthetic value, thousands	--	$792	--	All to Sri Lanka.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	260,750	405,436	--	Singapore 335,345; Malaysia 70,090.
Worked	6	--		
Sand excluding metal-bearing	--	2,867	--	Singapore 2,866.
Other:				
Crude	--	10,052	NA	Singapore 8,475.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	--	10,088	--	Sri Lanka 8,698; Hong Kong 1,390.

See footnotes at end of table.

Table 2.—Indonesia: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades including briquets	31,673	59,595	NA	Malaysia 23,950; Thailand 9,000; Republic of Korea 5,516.
Gas, natural ---- million cubic feet	26,463	473,986	42,242	Japan 387,552; New Zealand 14,226.
Petroleum:				
Crude ---- thousand 42-gallon barrels	518,022	443,952	117,252	Japan 231,403; Singapore 49,150; Trinidad and Tobago 22,904.
Refinery products:				
Gasoline, motor ---- do	101	86	NA	Singapore 5.
Kerosine and white spirit ---- do	329	138	NA	Thailand 6.
Distillate fuel oil ---- do	1,563	NA	NA	NA.
Residual fuel oil ---- do	29,765	36,870	11,322	Japan 25,175; Singapore 195.
Mineral jelly and wax ---- do	205	238	--	Singapore 233; Philippines 5.

NA Not available.

Table 3.—Indonesia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	320	NA	NA	NA.
Oxides and hydroxides	21,866	NA	NA	NA.
Metal including alloys:				
Scrap	42	NA	NA	NA.
Unwrought	12,288	15,150	581	Canada 5,907; Japan 3,381; New Zealand 2,107.
Semimanufactures	18,363	15,906	544	Japan 4,699; Romania 1,780; Singapore 1,332.
Arsenic trioxide, pentoxide, acids	142	NA	NA	NA.
Chromium:				
Ore and concentrate	41	NA	NA	NA.
Oxides and hydroxides	220	NA	NA	NA.
Cobalt oxides and hydroxides	9	NA	NA	NA.
Copper:				
Sulfate	100	NA	NA	NA.
Metal including alloys, all forms	18,240	20,852	40	Japan 13,433; Zambia 3,792; Australia 2,127.
Gold metal including alloys, unwrought or partly wrought ---- troy ounces	183,902	71,214	NA	United Kingdom 41,635; Switzerland 15,593; West Germany 13,503.
Iron and steel:				
Ore and concentrate	55,070	53,159	--	Brazil 53,133.
Metal:				
Scrap	80,690	29,770	NA	West Germany 15,526.
Pig iron, cast iron, spiegeleisen	32,469	43,523	--	Australia 15,387; Algeria 10,446; Spain 10,328.
Sponge iron, powder, shot	260	428	NA	NA.
Ferroalloys	4,172	7,067	NA	Australia 3,253; India 751; Japan 315.
Steel, primary forms	203,456	268,716	13	West Germany 29,931; Republic of Korea 28,264; Mozambique 19,029.
Semimanufactures:				
Bars, rods, angles, shapes, sections	240,498	189,066	647	Japan 134,162; Australia 19,317
Universals, plates, sheets	662,731	776,452	17,430	Japan 616,892; Republic of Korea 59,285
Hoop and strip	37,821	40,101	NA	Japan 32,511; Australia 2,926.
Rails and accessories	16,200	16,203	--	West Germany 3,738; Japan 3,249; Australia 2,068.

See footnotes at end of table.

Table 3.—Indonesia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Wire	5,980	8,641	NA	Japan 4,408; Australia 1,031.
Tubes, pipes, fittings	185,873	119,308	20,563	Japan 75,727; Singapore 14,342.
Castings and forgings, rough	5,192	5,687	431	Singapore 1,432; Japan 1,302.
Lead:				
Oxides	1,125	NA	NA	NA.
Metal including alloys, all forms	7,243	51,004	206	Australia 45,547; Japan 2,073.
Magnesium metal including alloys, all forms	21	NA	NA	NA.
Manganese:				
Ore and concentrate	8,605	6,966	NA	Singapore 4,798.
Oxides	4,067	NA	NA	NA.
Mercury 76-pound flasks	653	NA	NA	NA.
Molybdenum metal including alloys, all forms	3	NA	NA	NA.
Nickel:				
Ore and concentrate kilograms	25	NA	NA	NA.
Metal including alloys, all forms	1,669	1,671	10	Japan 1,452; West Germany 77.
Platinum-group metals including alloys, all forms troy ounces	3	NA	NA	NA.
Silver metal including alloys, all forms do	16,398	(1)		
Tin metal including alloys, all forms	220	175	NA	NA.
Titanium oxides	7,603	NA	NA	NA.
Tungsten metal including alloys, all forms	12	NA	NA	NA.
Uranium and thorium oxides including rare-earth oxides	165	NA	NA	NA.
Zinc:				
Oxides	248	NA	NA	NA.
Metal including alloys:				
Unwrought	44,617			
Semimanufactures including blue powder	1,146	1,163	76	Japan 703; Peru 100.
Other:				
Ores and concentrates	258	813	NA	NA.
Oxides, hydroxides, peroxides of metals	273	[2]17,922	613	Japan 6,954; Singapore 3,124; West Germany 2,886.
Metals:				
Metalloids: Phosphorus	64	NA	NA	NA.
Alkali, alkaline-earth, rare-earth metals	16	NA	NA	NA.
Pyrophoric alloys	47	NA	NA	NA.
Base metals including alloys, all forms	471	NA	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	281	(3)		
Grinding and polishing wheels and stones	1,090	2,281	NA	Republic of Korea 650; China, mainland 380; West Germany 82.
Asbestos	14,781	14,616	7	Canada 6,936; Australia 2,809; China, mainland 1,620.
Barite and witherite	22,295	NA	NA	NA.
Boron materials:				
Crude natural borates	1	NA	NA	NA.
Oxide and acid	295	NA	NA	NA.
Cement	420,199	148,108	6,077	Japan 99,874; Singapore 18,371; Thailand 12,403.
Chalk	638	NA	NA	NA.
Clays and clay products:				
Crude clays:				
Bentonite	25,313	NA	NA	NA.
Kaolin	8,247	NA	NA	NA.
Kyanite and sillimanite	(4)	NA	NA	NA.
Other	7,649	NA	NA	NA.
Products:				
Refractory including nonclay brick	24,603	20,517	2,371	Japan 5,463; China, mainland 3,559; Netherlands 1,322.
Nonrefractory	3,723	2,575	NA	Japan 792; Italy 524.
Cryolite and chiolite	1	NA	NA	NA.
Diamond, industrial carats	52,500	NA	NA	NA.

See footnotes at end of table.

Table 3.—Indonesia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diatomite and other infusorial earth	508	NA	NA	NA.
Feldspar, leucite, nepheline, nepheline syenite	6,766	NA	NA	NA.
Fertilizer materials:				
Crude:				
Nitrogenous	300	868	--	NA.
Phosphatic	3	16,201	NA	Jordan 9,450; Australia 6,500.
Potassic	201	1,601	--	West Germany 1,501.
Other including mixed	1,039	23	NA	NA.
Manufactured:				
Nitrogenous	43,833	40,299	9,992	Republic of Korea 25,300; West Germany 5,000.
Phosphatic	278,039	200,188	26,660	Romania 46,604; Jordan 37,037; Tunisia 20,000.
Potassic	107,667	140,883	1,550	West Germany 61,722; U.S.S.R. 20,834; East Germany 10,130.
Other including mixed	21,243	16,747	NA	West Germany 10,754; Japan 2,503; Denmark 2,115.
Ammonia	319	NA	NA	NA.
Graphite, natural	170	NA	NA	NA.
Gypsum and plasters	157,757	287,720	NA	Australia 170,725; Japan 61,329; Republic of Korea 39,200.
Lime	741	1,009	NA	NA.
Magnesite	440	NA	NA	NA.
Mica, all forms	386	NA	NA	NA.
Pigments, mineral:				
Natural, crude	639	NA	NA	NA.
Iron oxides, processed	1,921	NA	NA	NA.
Precious and semiprecious stones except diamond value	$470	NA	NA	NA.
Pyrite (gross weight)	11	11	NA	NA.
Salt and brine	2,735	2,607	486	West Germany 836.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	28,244	NA	NA	NA.
Caustic potash	900	NA	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	675	NA	NA	NA.
Worked	3,653	7,344	NA	China, mainland 6,309; Italy 851.
Dolomite, chiefly refractory grade	1,342	NA	NA	NA.
Gravel and crushed rock	920	606	NA	NA.
Limestone except dimension	431	NA	NA	NA.
Quartz and quartzite	339	NA	NA	NA.
Sand excluding metal-bearing	1,880	2,079	428	NA.
Sulfur:				
Elemental:				
Other than colloidal	1,335	2,643	NA	Singapore 1,691.
Colloidal	45,748	NA	NA	NA.
Sulfur dioxide	31	NA	NA	NA.
Sulfuric acid	4,382	NA	NA	NA.
Talc, steatite, soapstone, pyrophyllite	11,159	NA	NA	NA.
Other:				
Crude:				
Meerschaum, amber, jet	40	NA	NA	NA.
Strontium and other minerals	379	NA	NA	NA.
Unspecified	--	[2]101,665	6,462	Thailand 22,655; China, mainland 21,149.
Slag, dross, and similar waste, not metal-bearing	5,944	NA	NA	NA.
Oxides and hydroxides of magnesium, strontium, barium	1,749	NA	NA	NA.
Halogens	16	NA	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	3,554	5,425	425	Singapore 3,808; Australia 248.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	39,713	NA	NA	NA.
Carbon black and gas carbon	17,649	NA	NA	NA.
Coal, all grades including briquets	2,517	4,082	--	Vietnam 4,026.
Coke and semicoke	17,729	25,163	--	Japan 13,000; Australia 3,030; West Germany 2,903.
Hydrogen and rare gases	20	NA	NA	NA.

See footnotes at end of table.

Table 3.—Indonesia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	16,417	22,528	--	All from Saudi Arabia.
Refinery products:				
Gasoline do	1,413	1,542	NA	Singapore 1,541.
Kerosine and white spirit do	5,875	12,578	22	Singapore 11,718; Liberia 683.
Distillate fuel oil do	2,767	NA	NA	NA.
Residual fuel oil do	1,596	3,735	8	Singapore 3,684; China, mainland 33.
Lubricants do	2,537	692	189	Singapore 212; Japan 91.
Other:				
Liquefied petroleum gas do	6	1	NA	NA.
Mineral jelly and wax do	21	23	1	West Germany 16; Netherlands 3.
Nonlubricating oils, n.e.s do	119	NA	NA	NA.
Pitch, petroleum coke, bitumen, bituminous mixtures do	799	604	NA	Singapore 567; Japan 4.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,760	2,190	NA	United Kingdom 828; Singapore 219; Japan 190.

NA Not available.
[1]Quantity unreported; imports valued at $272,000, mainly from Australia and West Germany.
[2]May include all unspecified nonmetals listed as NA elsewhere for 1979 in this table.
[3]Quantity unreported; imports valued at $246,000.
[4]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Production of bauxite by P.T. Aneka Tambang from its open pit mines on Bintan Island and the nearby islets of Angkut, Dendang, Kelong, and Tembeling totaled about 1.1 million tons in 1980. Japan continued to import most of the Indonesian bauxite; and in 1979, 91% went to Japan, and the remainder was shipped to the Netherlands. High-grade trihydrate bauxite normally requires less energy than the monohydrate to produce alumina.

During 1980, the feasibility studies for developing a bauxite mine and an alumina production facility in Indonesia were completed by a Japanese consortium composed of Showa Aluminum Industries K.K., Nippon Light Metal Co. Ltd., Sumitomo Aluminum Smelting Co. Ltd., Mitsubishi Light Metal Industry Ltd., and Mitsui Aluminum Co. Ltd. A final report, which includes site recommendation and cost of the alumina plant, was submitted to the Indonesian Government. The final decision for the alumina project was to be officially announced in early 1981. According to the feasibility studies, an Indonesia-Japan joint venture firm would be established to mine the below export-grade bauxite in the Tayan region of West Kalimantan, with a mining capacity of 3 million tons per year, and a 600,000-ton-per-year capacity alumina plant would be built in Sumatra. Seventy-five percent of the total alumina production would be shipped to the forthcoming Asahan smelter at Kuala Tanjung in North Sumatra, and the remaining 150,000 tons of alumina would be exported.[4]

The Asahan aluminum project, carried out and owned by P.T. Indonesia Asahan Aluminum (IN-ALUM), was in its third year of construction. Work on the aluminum smelter and the two hydroelectric power stations was proceeding according to schedule.

Construction work at both power stations was the most difficult part of the whole project. The first 286-megawatt power station at Sigura-gura would have an intake dam standing 48.5 meters high at an elevation of 500 meters above sea level, while the powerplant was 200 meters below the earth's surface. The second 317-megawatt power station at Tangga would have an intake dam standing 73 meters high; however, the power station was at ground level.

Construction work at the smelter site, Kuala Tanjung, about 50 miles southeast of Medan, was about 50% completed. At

Kuala Tanjung, which covers an area of 200 hectares, a 510-cell reduction plant equipped with a gas cleaning system; a carbon plant consisting of a green carbon plant, anode baking plant, and rodding plant; a casting shop; and maintenance shop were to be built. A new port at Kuala Tanjung was about 80% to 90% complete. Other infrastructures including a company town and camp facilities, roads, water, and electricity were about 50% complete.

The first-stage production capacity would be 75,000 tons per year in 1982; the second-stage production capacity would be 150,000 tons per year in 1983; and the third-stage production capacity would be 225,000 tons per year in 1984.[5] If the plan for a 600,000-ton-per-year alumina refinery in Sumatra had not materialized by 1982, Indonesia would be forced to import large quantities of alumina annually to provide feedstock for the Asahan aluminum smelter. In 1980, a contract between IN-ALUM and three Japanese alumina producers was reportedly signed for the Asahan smelter to import alumina from Japan—100,000 tons in 1981, 245,000 tons in 1982, and 340,000 tons in 1983.[6]

IN-ALUM is owned 75% by Nippon Asahan Aluminum Co. (invested 50% by the Overseas Economic Cooperation Fund of Japan, 32.5% by five Japanese aluminum smelting companies headed by Sumitomo Aluminum Smelting Co. Ltd., and 17.5% by seven integrated trading firms headed by Mitsubishi Corp.), and 25% by the Indonesian Government. Of the estimated Asahan's total project cost of $2.1 billion, $460 million, or 22.2%, would be equity capital of the company and the remaining $1.6 billion, or 77.8%, was to be funded by borrowing (30% from Indonesia and 70% from Japan).

The proposal to develop the below export-grade bauxite on Bintan Island was dropped, mainly because of the high silica content.

Copper.—Copper production of Indonesia was by P.T. Freeport Indonesia, Inc., which operates an open pit mine and concentrator at Gunung Bijih, Tambagapura (Ertsberg) of Irian Jaya. Output of copper ore in 1980 remained at about the same level as that of 1979, but the average copper content of the ore in 1980 declined to about 2% from 2.1% in 1979. The concentrator was operating at 83% to 84% of its 225,000-ton-per-year capacity.

The $101.5 million expansion program of the new underground mine at Ertsberg East, near its existing open pit mine, was ahead of schedule. Ore production from this underground block caving mine was planned to begin at 4,500 tons of ore per day before the end of 1980. The annual output of the existing open pit mine and new underground mine was expected to increase to 135 million pounds of copper in 1981 from 126 million pounds produced in 1980. Upon completion of the project in 1983, Ertsberg East underground mine was expected to operate at 9,500 tons of ore per day. By 1983, the combined annual output of Freeport was projected to be 180 million pounds of copper, 72,000 ounces of gold, and 1.2 million ounces of silver. The copper reserves at Ertsberg East were estimated to have 45 million tons of ore averaging 2.64% to 2.75% copper content, plus unspecified gold and silver values.

For the past 7 years since Freeport began operating, all its copper output (in the form of concentrates, averaging 31% Cu) was exported to Japan (70%) and the Federal Republic of Germany (30%). In June 1980, the long-term sales contract between Freeport and Norddeutsche Affinerie (NA) of the Federal Republic of Germany (has 3.5% interest in Freeport) expired. It was reported that Freeport had replaced its contract with NA by "an international trader" to take 25% of Freeport's copper output from Ertsberg East for the 1980-91 period. For the next 10 years the remaining 65% to 75% of output would be exported to Japan, based on the renewed long-term sales contracts between Freeport and two Japanese smelter and refineries.

P.T. Tropic Endeavor Indonesia, a joint venture firm of Endeavor Resources Ltd. of Australia and Utah Exploration Inc. of the United States, reportedly was acquired by Utah Exploration Inc. in mid-1980. According to the agreement, Utah paid Endeavor $1.1 million at the signing of the agreement, and was to pay $5.5 million by September 1, 1981. Additionally, Utah will pay Endeavor a 1.5% royalty from the future output value of the property at Kayubulan Ridge. Utah Exploration Inc., a wholly owned subsidiary of Utah International, Inc., of the United States, continued the exploration activities at the Kayubulan Ridge porphyry copper prospect, located in the Motomboto-Tombuililato region of Sulawesi. An additional $3.3 million was expected to be spent on exploration in the area for the 1980-81 period. Based on earlier drilling by Endeavor, the Kayubulan Ridge

porphyry copper deposit contains 196 million tons of ore, averaging 0.74% copper and 0.1 troy ounces of gold per ton of ore.[7]

Gold and Silver.—Gold and silver production in Indonesia were mainly by P.T. Aneka Tambang and by P.T. Freeport Indonesia, Inc. In 1980, gold and silver production by Aneka Tambang from its Cikotok Mine, about 5 miles north of Bayah in South Banten, West Java, totaled 247 kilograms of gold and 2,189 kilograms of silver, compared with 170 kilograms of gold and 1,645 kilograms of silver produced in 1979. The increase was due to additional mine output from Cirotan, Hatemi, Labak Sembada, and Cierang in the South Banten area. Output of gold and silver as byproducts of Freeport's copper project at Ertsberg in Irian Jaya reportedly had shipments of 52,000 troy ounces of gold and 608,000 troy ounces of silver. The gold and silver recovered by the Freeport copper operation was averaging 0.31 troy ounces of gold and 4.11 troy ounces of silver per ton of concentrate.

Endeavor Resources Ltd. of Australia started a feasibility study on development of alluvial gold deposits near Marisa in North Sulawesi. The study was expected to be completed early in 1981. Utah Exploration, Inc., reportedly would also participate on the investigation of the gold deposits in Marisa hinterland held by Endeavor.

Iron Sands.—In 1980, there were two iron sand mines operated by the state-owned P.T. Aneka Tambang; the Cilacap Mine in Central Java, and the Palabuhanrata Mine in West Java. In 1980, output of the Palabuhanrata Mine remained at the same level as that of 1979 at about 44,000 tons of iron sand concentrates. The output of iron sand concentrate from the Cilacap Mine continued to drop because of a dispute over export price and quantity with the Japanese buyer, Nippon Kokan Kabushiki Kaisha. Most of the iron sand was consumed by the domestic cement industry, and only a small portion of iron sands (55% to 56% Fe, 8% to 10% TiO_2) was exported to Japanese Kanematsu Gosho Ltd.

Manganese.—Production of manganese ore in Indonesia was by the state-owned P.D. Pertambangan Jawa Barat and two private firms; P.T. Panca Ubaya Paksi and P.T. Kiswoyo Jaya. Recovery of manganese ore was by washing and hand sorting, mainly in Karangnunggal, Southern Tasikmalaya, West Java, and the special Province of Yogyakarta. Annual output of the ore from these areas remained at about 6,000 tons since 1977.

In 1980, a new manganese ore deposit was being mined in the Bima area of the West Nusa Tenggara Islands by P.T. Miga Lima. Based on surveys conducted by the company, ore reserves on this 4,000-hectare site in Bima, Sumbawa, West Nusa Tenggara were estimated at 50 million tons of manganese ore and 40 million tons of perlite. By mid-1980, about 15,000 tons of manganese ore was being produced from this area. A special seaport called Sarae Bure, about 22 miles west of Bima, was being constructed at Waworada Bay to handle the ore exports, and a 9-mile road to link the port and the manganese mining site at Pela Simpasai was also being built. The cost of the new port was estimated at $3.2 million, and was expected to be completed by 1981. It was reported that the first 7,000 tons of manganese ore, under a 360,000-ton contract, were shipped to Taiwan in late 1980. The 3-year contract calls for shipment of 120,000 tons of manganese ore to Taiwan annually.[8]

Nickel.—Indonesia remained one of the world's important nickel producers. In 1979, the country's nickel mine output accounted for about 4% of the world's total nickel mine production. Nickel ore mining and smelting were by the state-owned P.T. Aneka Tambang and P.T. International Nickel Indonesia.

P.T. Aneka Tambang operated nickel mines in the Pomalaa area of southeast Sulawesi, and at Oeboelie deposit in Moluccas on Gebe Island, as well as a ferronickel smelter at Pomalaa in Sulawesi. The smelter received annually about 350,000 to 400,000 tons of wet ore containing 2.5% (Ni+Co) from the Pomalaa Mine, and produces about 20,000 tons of ferronickel (high carbon and low carbon) ingots annually. In an effort to boost nickel ore exports, the Government began a feasibility study on developing new mines around Buli Bay in North Moluccas on Gebe. Nickel ore output in 1979 from the Oeboelie deposit was 402,076 tons. Output of nickel ore and ferronickel by the company was exported mainly to Japan.

P.T. International Nickel Indonesia, a subsidiary of International Nickel Co., Ltd., of Canada, operated a large nickel mine and refining facility at Soroako in South Sulawesi. In 1980, most of the production problems had reportedly been resolved by blending the less acidic low-grade nickel ore with more acidic high-grade nickel ore for

the process plant and by adding the cooling devices to the furnaces. Output of nickel in matte from the Soroako operation increased from 8,620 tons in 1979 to 19,500 tons in 1980.[9]

Tin.—In 1980, Indonesia became the world's fourth largest tin producer as the country's output of tin-in-concentrate reached over the 32,000-ton-level for the first time since 1954. The continuing high price of tin and the operation of two new large offshore dredges (Bangka II of P.T. Tambang Timah and Bima of P.T. Riau Tin Mining) were the two contributing factors to the increase in tin output of Indonesia in 1980. Indonesia's tin export earnings climbed 23% to $461 million in 1980 from $376 million recorded in 1979.

Production of tin in Indonesia was by the state-owned P.T. Tambang Timah, and three joint venture companies, P.T. Koba Tin, P.T. Broken Hill Proprietary Indonesia, and P.T. Riau Tin Mining, under a contract-of-work agreement with the Indonesian Government. The country's tin industry employed a total of 29,700 persons in 1980. Over 90% of the total labor force was working in various tin mining areas concentrated on Bangka Island, Belitung Island, and at the Mentok tin processing plant.

P.T. Tambang Timah operated 30 bucketline dredges and 125 hydraulic mines around Bangkinang on Sumatra and Bangka Island, Belitung Island, and the islands of Singkep, Kundur, and Karimum. The firm produced about 85% of the country's total tin production in 1979. About 74% of the firm's tin output was from Bangka; 21% was from Belitung; and the remainder was from Singkep, Kundur, and Karimum. In an effort to increase tin production, as well as replacing the aging dredge fleet (about two-thirds of dredges are 40 years old), the firm's second new large dredge Belitung I, was being built by Mining and Transportation Engineering N.V. of Amsterdam and P.T. McDermott Co. of the United States on Batam Island in Indonesia. The $27 million Belitung I will be able to dredge tin ore up to a depth of 164 feet compared with a depth of 150 feet for Bangka II. Belitung I was scheduled to be completed by April 1981, and would be operating in the Kelapa Kampit area of Belitung. A third new dredge, to be named Singkep I, with the same capacity as Belitung I, would be built during 1981-83 and would be operating in the Kundur and Karimum Island region.[10]

P.T. Koba Tin, a subsidiary of Kajuara Mining Corp. Pty. Ltd. of Australia, operated in the Koba district of Bangka Island. The firm's tin production in 1980 had increased more than four times over production in 1976, and accounted for about 13% of the country's total tin production in 1979.

P.T. Broken Hill Proprietary Indonesia, a subsidiary of the Broken Hill Proprietary Co., Ltd., of Australia, operated an underground tin mine at Kalapa Kampit on Belitung. Its tin production was 469 tons in 1979.

P.T. Riau Tin Mining, a subsidiary of Royal Dutch/Shell Group of the Netherlands, began operating the world's largest dredge in late 1979, offshore Cebia Island and around Tujuh Islands between Bangka and Singkep Islands. The $33 million dredge, Bima, is capable of producing 2,500 tons of tin per year. However, the company produced only 95 tons of tin in 1979 and averaged only 100 tons per month of tin during 1980, because of technical problems and delays.

Production of tin metal in Indonesia was by Peltim, a production unit of P.T. Tambang Timah, at Mentok on Bangka Island. The smelter produced 27,790 tons of tin metal in 1979.

Uranium.—In mid-1980, large uranium deposits were reportedly discovered in a 200-square kilometer area of Ngada district on Flores Island.

An agreement on joint exploration and development of uranium resources in southern Sumatra was expected to be formalized between Indonesia and Japan by the end of 1980. Under the agreement, Japan would provide an estimated $3 million for a 3-year survey, using its technological knowhow and equipment.

The National Atomic Energy Institute of Indonesia decided to suspend investigations in Devel's Hill on Timor Island because of poor prospects for uranium development.

NONMETALS

Cement.—Despite the spectacular growth of Indonesia's cement industry during the 1977-79 period, the country reversed its export position in 1980 to import about 100,000 tons of cement from Japan, the Republic of Korea, and the Philippines to meet the shortage of cement in West Irian, Sulawesi, and North Sumatra areas. The development of the cement shortage in 1980 was caused by a drastic increase in demand for cement because of the construction boom in the country, and a reduction of supply because of the overhaul of two ce-

ment plants. Despite the continuing growth of demand for cement, Indonesia was expected to be a net exporter during the 1981-84 period, and to be in a balance position by 1985. Based on the projection made by Indonesia Cement Association, the country's projected supply and demand for cement was as follows, in thousand tons:

Year	Production	Consumption	Exports
1981	8,400	7,200	1,200
1982	10,130	8,650	1,480
1983	11,810	10,380	1,430
1984	12,726	12,456	1,270
1985	14,947	14,947	--

Total demand for cement in Indonesia was estimated at 6 to 6.3 million tons in 1980. Cement production by company in 1979 and projected capacity by company in 1980-81 were as follows, in thousand tons:

Company	Location	Production 1979	Capacity 1980	Capacity 1981
P.T. Semen Gresik	Gresik, East Java	1,177.4	1,500	1,500
P.T. Semen Cibinong	Narogong, West Java	1,043.8	1,200	1,200
P.T. Indocement	Citeureup, West Java	1,300.3	2,000	2,000
P.T. Semen Nasantara	Cilacap, Central Java	684.4	750	750
P.T. Semen Padang	Indarung, Sumatra	361.5	[1]930	930
P.T. Semen Tonassa	Ujung Pandang, South Sulawesi	128.6	[2]620	620
P.T. Baturaja	Baturaja, South Sumatra	--	--	500
Total		4,696	7,000	7,500

[1]Includes Padang I, 338,000 tons per year; Padang II 600,000 tons per year, which was scheduled for completion during 1980.

[2]Includes Tonassa I, 120,000 tons per year; Tonassa II, 500,000 tons per year, which was scheduled for completion during 1980.

By 1985, three other cement plants were expected to be built at Lhoknga in Aceh, Kupang in Timov, and Bahorok in North Sumatra. P.T. Semen Andalas awarded a $115 million contract to a Japanese Consortium composed of Mitsubishi Corp. and Kobe Steel Ltd. in August 1980. The consortium was to construct a 1-million-ton-per-year capacity cement plant, on a full turnkey basis, at Lhoknga in Aceh on the northern tip of Sumatra. The contract calls for Kobe Steel Ltd. to provide engineering, supply of equipment, and field construction of the plant, including harbor facilities at Lhoknga, and construction of a packing plant in Belawan.[11]

Fertilizer.—Indonesia's fertilizer industry continued to grow in 1980. The industry produced nitrogen, phosphate, and complex fertilizer. Production of nitrogen fertilizers was by two state-owned fertilizer companies, P.T. Pupuk Sriwijaya (Pusri) and P.T. Pupuk Kujan. Production of phosphate and complex fertilizer was by the third state-owned company, P.T. Petrokimia Gresik. Fertilizer production and capacity in 1980 by company and product were as follows, in thousand tons:

Company	Location	Production	Annual capacity	Product
P.T. Pupuk Sriwijaya (Pusri I, II, III, and IV).	Palembang, South Sumatra.	1,400	1,620	Urea.
P.T. Pupuk Kujan	Tjikampak, Java	456	570	Do.
P.T. Petrokimia Gresik	Gresik, East Java	NA	330	Triple superphosphate.
		NA	80	Diammonium phosphate.
		NA	50	Nitrogen, phosphate, and potassium.
	Surabaja, East Java	NA	45	Urea.
		NA	150	Ammonium sulfate.
Total			2,845	

NA Not available.

During the 1976-78 period, about 160,000 to 200,000 tons of nitrogen fertilizer was exported annually to India, the Philippines, Malaysia, Pakistan, and Bangladesh. Despite the continuing growth of the country's nitrogen fertilizer capacity, the exports of urea were cut back substantially in 1980. First, there was a shortage of natural gas feedstock caused by difficulty with equipment in the South Sumatra Gasfield which provides gas to the Palembang fertilizer complex. Second, the domestic demand for the nitrogen fertilizer was rising at a rapid rate, stimulated by various Government price support policies. To keep up with the domestic consumption of nitrogen fertilizer, it was expected that Indonesia would import fertilizer in 1981. Data on three new fertilizer projects, scheduled to be completed by the end of the third 5-year plan, are as follows:

Company	Location	Annual capacity (thousand tons)	Product	Completion date
P.T. Pupuk Kaltim	Bontang, East Kalimantan	258	Urea	1982
P.T. Asean-Aceh Fertilizer	Lhokseumane, Aceh, North Sumatra.	570	do	1984
P.T. Petrokimia Gresik	Tjilatjap, Java	184	Triple, superphosphate.	1985
		12.6	Aluminum fluoride	

P.T. Pupuk Kaltim's project at Bontang involved the installation of a 406,000-ton-per-year N ammonia unit in the urea plant; total project cost was estimated at $240 million, with $150 million foreign financing from West European sources.

P.T. Asean-Aceh fertilizer project, an Asean-sponsored project, reportedly had revised the total development cost to $403 million (was $313 million in 1977), with a $309 million loan from two Japanese Government financial institutions (the Overseas Economic Corporation Fund and the Export-Import Bank of Japan); and the remainder by Indonesia (60%); Malaysia, the Philippines, and Thailand (13% each); and Singapore (1%).

Under an agreement signed in December 1980, Toyo Engineering Corp. of Japan was to supply the fertilizer plant.

P.T. Petrokimia awarded a contract to Sim-Chen Ltd., a member of the Simon Engineering Ltd. group of the United Kingdom, as the technical adviser for the expansion of its fertilizer complex in East Java. The two-stage construction project was to start in 1982 and be completed by 1985. Upon completion of phase 1, a 184,000-ton-per-year triple superphosphate plant would be added to the existing 330,000-ton-per-year plant at Gresik. In phase 2, a 162,000-ton-per-year phosphoric acid plant, a 500,000-ton-per-year sulfuric acid plant, and units for the production of ammonium sulfate and aluminum fluoride were to be added. The total cost of the expansion project was estimated at $250 million.

Other Nonmetals.—Granite production in Indonesia was by P.T. Karimum Granite on Karimun Island and by small operators in many localities. About 32% of the output was consumed domestically, and 68% was exported to neighboring countries (mainly to Singapore).

Iodine was produced by P.T. Kimia Farma, at Watudakon, Mojokerto, East Java, from brines. Output of iodine varied greatly each year. In 1979, about 14,700 kilograms of iodine was exported to Australia (6,800 kilograms), the United States (6,000 kilograms), Taiwan (1,000 kilograms), and New Zealand (900 kilograms).

Kaolin production in Indonesia was by 19 companies operated on Belitung and Bangka Islands, and in North Suluwesi. In 1979, about 74% of the total output was from Belitung Island, and 25% was from Bangka Island. Most of the kaolin output was consumed by the domestic ceramic industry, paint manufacturing, rubber, and cosmetic industries.

Quartz sand and silica stones were produced on Bangka and Belitung Islands, and in Central and East Java. Marble production was by P.T. Industri Marmar Indonesia Tulungagung. Most of the output of marble slabs was shipped to Jakarta and Java Timur to make ornamental stone.

MINERAL FUELS

Coal.—P.N. Tambang Bartubara Bukit Asam, the state-owned company, operates open pit Bukit Asam Mine in South Sumatra (accounting for two-thirds of out-

put), and the underground Ombilin Mine in Sawahlunto, West Sumatra (accounting for one-third of output). In 1979, domestic consumption of coal totaled 188,403 tons; 59,595 tons of coal was exported mainly to Malaysia (40%), Taiwan (28%), and Thailand (15%). The configuration of domestic coal consumption in 1979 by end use was as follows, in tons:

Railroad, state-owned company-PJKA	26,125
Tin smelting, state-owned company-P.T. Timah	26,225
Nickel smelting, state-owned company-P.T. Aneka Tambang	12,002
Cement plant, state-owned company-P.T. Semen Padang	56,896
Coal mines	57,815
Other	9,340
Total	188,403

P.N. Tambang Batubara reportedly was to purchase five bucket-wheel excavators from Rheinbraun of Cologne of the Federal Republic of Germany. Rheinbraun was to be placed in charge of mine site development at Bukit Asam. A Canadian consortium (Montreal Engineering, Swan Wooster, and Canadian Pacific) completed a study on coal transportation and an upgraded railway system to a new port on the southern tip of South Sumatra. The study reportedly had been submitted to the Government of Indonesia in October 1979. Alternative routes (eastern route and southern route) were proposed by the consortium, and the Government had decided in favor of the southern route. This route would have a longer rail haul, which would run across South Sumatra to open up the agriculture of Lampung Province, as well as to assist cement transport from the forthcoming Baturaja cement plant to West Java. Total capital investment, including interest during construction, was estimated at $830 million. The financing of the project would be sponsored by the World Bank. In June 1980, the Federal Republic of Germany reportedly would extend a loan of 120 million deutsche marks to Indonesia, and a portion of this loan would be allocated to the mine development and expansion of Bukit Asam.

An agreement between Indonesia and the French Government was signed in mid-1980 for building a 100-megawatt coal-fired powerplant in the Bukit Asam mining area. About one-half of the plant's generating capacity would be utilized for coal production, and the remaining surplus electricity would be for general distribution in the South Sumatra area. Construction of the powerplant was expected to begin in 1981 with aid of approximately 420 million francs from the French Government and technical assistance in design by a French consulting firm, Sofrelec. Babcock & Wilcox Canada Ltd. and Marubeni Corp. of Japan were awarded a contract worth more than $150 million to supply a 800-megawatt coal-fired powerplant at Suralaya in West Java. The powerplant was scheduled to be operational in 1984 and to supply electricity to Jakarta and Central Java.[12]

A coal preparation plant, with an hourly capacity of 150 tons, was being built at Ombilin with a $4 million Australian Government loan. The preparation plant was scheduled to be completed in 1981.

Based on the latest Government figures, coal reserves at Bukit Asam were estimated at 223 million tons of subbituminous coal. Heat value ranged between 5,000 and 6,500 calories per gram, and the coal contained up to 3% ash and less than 0.5% sulfur. Coal reserves at Ombilin were estimated at 95 million tons of coal, with heat value averaging 7,000 calories per gram, up to 7% ash and averaging 0.5% sulfur. Most of the coal from the mines is suitable for fuel in electric powerplants and as industrial fuel, such as for coal-fired cement plants.

Petroleum and Natural Gas.—Indonesia's crude oil production continued its decline throughout 1980, and output averaged 1.56 million barrels per day. The total output of crude oil for 1980 represented an 11% drop from output of 1979. Beginning in 1981, oil output was expected to be about 1.64 million barrels per day and gradually increase to 1.83 million barrels per day by 1983.

P.T. Caltex Pacific Indonesia (CPI), the largest single crude oil producer in Indonesia, started oil production at its seven new fields in Central Sumatra on March 3, 1980. Beruk Oilfield, located about 36 miles east-southeast of CPI's Minas Field (north of Pakanbaru), was producing 23,000 barrels per day from 10 wells in 1980. Six new oilfields—Tanjung Medan, Buaya, Kerang, Jorang, Rokiri, and Topi (all located northwest of the Minas Field)—were producing at a combined total of 19,000 barrels per day. The total 42,000-barrel-per-day output of oil from these seven new fields helped CPI to maintain its 750,000-barrel-per-day output in 1980. The Beruk Oilfield is only part of CPI's Beruk-Zamrud project, that includ-

ed Beruk, Northeast Beruk, Bamgus, and Zamrud. The entire Beruk-Zamrud project was expected to be completed with a peak production rate of 80,000 barrels per day of oil in 1983. The total project cost was estimated at $87.2 million.[13] CPI (50% owned by Texaco Inc. and 50% by Standard Oil Co. of California) operates as a contractor to Indonesia's state-owned oil company, Pertamina; CPI produced about 48% of the country's total oil output in 1980.

Independent Indonesia American Petroleum Co. (Iiapco), the fifth largest crude oil producer in Indonesia, began production at the newly discovered Krisna Oilfield in December 1980. The Krisna Field, located offshore southeast of Southeastern Sumatra, was discovered in 1976 near the company's Cinta-Rama oil production complex. By June 1980, 10 development wells were sunk. The field's first production platform came onstream with an initial production of 36,000 barrels per day of oil in December 1980. The second platform was scheduled to come onstream with an output of 20,000 barrels per day of oil in February 1981. The combined total output of 55,000 to 56,000 barrels per day of oil could be stabilized to about 40,000 barrels per day by 1981.[14] Iiapco, a division of Natomas International Co. of San Francisco (United States) operating as a contractor to Pertamina, produced about 5% of the country's total crude oil in 1980.

During 1980, numerous new oil and gas wells were discovered in Indonesia. The following summarizes only the significant discoveries by seven companies (flow data for oil given in barrels per day and for gas, million cubic feet):

Company and well name	1980	Location	Well	Flow oil (barrels per day) gas (million ft³)
Atlantic Richfield Indonesia:				
ETA	July	Offshore north of West Java	Oil	4,700
UV	do	do	Oil	3,400
UX	do	do	Oil	3,200
Bangkudulis-1	March	Onshore East Kalimantan	Oil	6,000
SW Sembankung-1	do	Onshore Northeast Kalimantan.	Oil	2,500
PSI UY-1	September	Offshore Southeast Sumatra.	Oil	3,000
Union Oil of Indonesia:				
Attaka 16	February	Offshore East Kalimantan	Oil	2,286
Attaka 18	August	do	Oil	11,385
Hudbay Oil (Malacca Strait):				
MUS-2	do	Offshore Northeast Sumatra.	Oil	7,092
Total Indonesie (CEP):				
N Tambora-1	May	Onshore East Kalimantan	Oil	2,360
Serban-1	March	Offshore East Kalimantan	Gas	19
Marathon Petroleum Indonesia:				
KH-IX	September	Offshore Natuna-Kakap	Oil	7,246
Mobil Oil Indonesia:				
S Lhok Sukon-A3	February	Onshore North Sumatra	Oil	188
			Gas	19.3
P.T. Caltex Pacific Indonesia:				
Pancake-1	June	Onshore South Sumatra	Oil	864
			Gas	7.1

Under attractive contractual environment for the new joint venture arrangements, oil exploration activities in Indonesia continued to increase in 1980. Based on Indonesian Government statistics, more than 200 exploratory wells were drilled in 1980 compared with 130 wells in 1979. During 1980, a total of 11 new production-sharing contracts were signed.[15]

Contractor	1980	Contract area (square kilometers)
Phillips	January	Irian Java-Kamura (22,305).
Amoco	do	Irian Java-Waipona (15,250).
Esso Exploration and Production Natuna.	May	Natuna Sea Block D-Alpha (5,700).
Union Texas	do	Tomori Block (5,700).
Conoco	June	Central Sumatra (6,500).
	November	Java Sea-Karimum Block (17,000).
Total Indonesie	June	Natuna, Block D-III (5,125).
	do	E. Kalimantan, Spasu Block (905).
Union	November	Java Sea-Madura (17,340).
Atlantic Richfield	do	Java Sea-Kangean Island (18,305).
AGIP/Ina Naftaplin	do	Java Sea-North of Bali (16,925).

The Government of Indonesia awarded a $950 million contract in February 1980 to two Spanish companies, Técnicas Reunidas and Centurnón (TRC) to build a hydrocracker unit for the Dumai oil refinery in Central Sumatra. Union Oil Products, Inc., of the United States was appointed as a licensee and the designer of the nine process units, utilities, and offsite facilities. Indonesia reportedly would finance the entire expansion project of the Dumai refinery itself. Upon completion of the Dumai refinery expansion in 1983, a daily output of 85,000 barrels would be added to the current capacity of 100,000 barrels per day.

In late 1980, the Government of Indonesia signed contracts with Bechtel Great Britain Ltd. for refinery expansion at Balikpapan in East Kalimantan. Fluor Engineers and Contractors of the United States was chosen for the refinery expansion project at Cilacap in Central Java. An additional 200,000-barrel-per-day capacity was to be added to each existing refinery by 1983. The total cost of both projects was estimated at more than $1.7 billion. In late 1980, the Japanese Government reportedly was prepared to provide $500 million of credit assistance to Indonesia for the expansion of both oil refineries.

Indonesia's natural gas production for 1980 remained at about the same level as that of 1979. The main use for the country's natural gas was by two state-owned LNG plants. The larger LNG complex at Arun, Aceh, was operating at full capacity (4.8 million tons per year) with three trains, and the LNG plant at Bontang, East Kalimantan, was also operating near full capacity (3.2 million tons per year) with two trains.

In order to increase LNG exports to Japan, Indonesia planned to double the existing capacity (8 million tons per year) of two LNG plants by 1983. Bechtel of the United States was to be awarded a $850 million contract as a major contractor for doubling the annual LNG capacity to 6.4 million tons per year at the Bontang plant in East Kalimantan. Construction was to start in early 1981 and to be completed by 1983. Financing of this LNG expansion project would be from four Japanese utilities, with an $800 million cash advance. In mid-1980, Pertamina and the Government of Japan were negotiating the financing of expanding the Arun LNG plant in North Sumatra from the current annual capacity of 4.5 million tons to 7.5 million tons by 1983. An agreement was finally reached in November 1980 between Indonesia and Japan for the construction of two additional production units under a Japanese loan.

Indonesia was ranked the 10th largest oil exporter in the world. Although the tonnage of crude oil exports declined in 1980, export earnings from crude oil increased about 50%, from $8.6 billion in 1979 to $13 billion in 1980.

Indonesian exports of LNG from Arun and Bontang earned over $1.5 billion in foreign exchange for 1980.

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[1]Economist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Indonesian rupiahs (Rp) to U.S. dollars at the rate of Rp625=US$1.00. U.S. Embassy, Jakarta, Indonesia. Economic Trends Report, State Department Airgram A-73, Oct. 21, 1981.

[3]ABECOR Country Report, Indonesia, December 1980, a publication of the ABECOR group of banks.

[4]Japan Chemical Week (Tokyo). V. 21, No. 1067, Oct. 2, 1980, p. 22.

[5]Metal Bulletin. No. 6576. Mar. 27, 1981, p. 15.

[6]World Mining (San Francisco). May 1980, pp. 91-92.

[7]Engineering and Mining Journal. V. 181, No. 4, April 1980, p. 174, v. 181, No. 6, June 1980, pp. 267-268.

[8]The Asian Wall Street Journal. Nov. 19, 1980, p. 3.

[9]U.S. Embassy, Jakarta. State Department Airgram A-67, Aug. 22, 1980, pp. 14-15. The Asian Wall Street Journal. Aug. 23, 1980, p. 5.

[10]Business Times (Kuala Lumpur). Sept. 1, 1980, p. 6.

[11]Pit & Quarry. August 1980, p. 19. Asia Mining. August 1980, p. 46.

[12]The Asian Wall Street Journal. July 23, 1980, p. 2. Asia Mining. September 1980, p. 38.

[13]Oil and Gas Journal. Aug. 11, 1980, p. 34. International Petroleum Times. Sept. 15, 1980, p. 6.

[14]Petroleum News. January 1981, pp. 21, 31.
Oil and Gas Journal. June 16, 1980, p. 54.

[15]The Asian Wall Street Journal. Nov. 19, 1980, p. 3.
Petroleum News. January 1981, pp. 24-29.

The Mineral Industry of Iran

By George A. Morgan[1]

The disruptions in the Iranian economy, brought on by the revolution that began in 1978 and continued through 1979, worsened in 1980. Major changes were affected in the position of Iran as a significant petroleum producer and in the development of its mineral industry. Exports of crude oil and refined products were nearly brought to a halt in April when the United States, the major trading partner, broke diplomatic relations and initiated economic sanctions for what it termed were breeches of international law by Iran. Subsequent support for the position by the members of the European Economic Community and Japan resulted in the loss of established export markets for the country's principal products. Military skirmishes with Iraq over border disputes in early 1980 erupted into open warfare in September. With the country in a state of war, the already meager amount of information on the country's mineral industry was further reduced. There were persistent reports of unavailability of parts and skilled labor. Rationing became commonplace as the impairment or complete destruction of oil and natural gas facilities forced the country to purchase supplies for which it had formally been self-sufficient, such as kerosine and jet fuel. Numerous reorganizations of Government agencies and private industry occurred as the Government attempted to follow up on its policy of nationalization and emphasis on domestic markets. A Ministry of Mines and Metallurgy was to be created to achieve greater control over mining and smelting operations.

PRODUCTION AND TRADE

At yearend 1980, a number of major oilfields in Khuzestan Province, such as Marun, Gach Saran, and Aghajari, appeared jeopardized due to fighting between Iran and Iraq. Kharg Island, the export terminal through which was shipped most of the crude oil produced in Khuzestan, was heavily damaged, while insurance rates for tankers sailing the Persian Gulf increased 300%. Crude oil continued to be exported through the Lavan Island and Sirri terminals, with capacities of 100,000 and 40,000 barrels per day, respectively. Some crude was also reported for sale at Kharg Island in late December for $28 per barrel, $7 below the official price, to compensate for increased insurance rates.

Although imports of iron and steel from the Federal Republic of Germany and France have been reduced significantly, the country imported large quantities of steel products in mid-1980, mainly from Belgium and Japan. The National Trading Co. had announced that it planned the import of considerably more iron and steel in 1980 than in 1979. Between April and June imports from Japan were at the rate of 130,000 to 150,000 tons per month.

Table 1.—Iran: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal, primary ingot	30,600	21,100	25,500	[e]14,000	10,000
Chromium: Chromite, gross weight	160,000	233,300	198,000	[e]136,000	80,000
Copper:[e]					
Mine output, metal content	6,000	13,500	20,000	5,300	3,600
Metal:					
Smelter	4,000	7,000	6,000	700	800
Refined	7,000	7,000	6,000	3,000	800
Iron and steel:					
Iron ore, gross weight thousand tons	1,070	1,100	1,560	[e]609	600
Metal:					
Pig iron do	625	[e]700	[e]900	[e]800	800
Steel, crude do	550	550	[e]780	[e]700	700
Lead, mine output, metal content	35,000	40,000	30,000	15,000	15,000
Manganese ore, gross weight	40,000	40,000	30,000	20,000	20,000
Zinc, mine output, metal content	72,000	61,500	[e]45,000	25,000	20,000
NONMETALS					
Barite	230,000	184,650	200,000	180,000	150,000
Cement, hydraulic thousand tons	6,100	7,256	12,000	9,000	9,000
Clays:					
Bentonite[e]	50,000	23,400	40,000	20,000	20,000
Fire clay	NA	72,201	[e]70,000	70,000	50,000
Kaolin	200,000	111,202	[e]180,000	160,000	150,000
Feldspar	NA	3,000	[e]3,000	3,000	2,500
Gem stones: Turquoise, crude	[e]70	82	35	NA	NA
Gypsum thousand tons	6,500	6,900	[e]8,000	7,000	7,000
Lime[e] do	1,000	1,000	900	500	500
Magnesite	5,000	5,000	5,000	[e]5,000	4,000
Nitrogen, N content of ammonia	230,200	271,300	178,400	183,300	217,800
Pigments, mineral, natural	4,588	3,500	[e]2,000	[e]1,000	500
Salt, rock[e] thousand tons	700	700	700	700	600
Sodium compounds: Caustic soda	18,000	NA	[e]20,000	[e]20,000	NA
Stone, sand and gravel:					
Limestone thousand tons	[e]8,000	9,000	15,000	NA	NA
Marble do	320	397	450	NA	NA
Silica do	300	300	NA	NA	NA
Travertine do	400	200	350	NA	NA
Other do	18,000	NA	NA	NA	NA
Strontium minerals: Celestite[e]	5,500	10,000	15,000	8,000	5,000
Sulfates, natural:					
Aluminum-potassium sulfate (alum)	NA	8,500	8,000	NA	NA
Sodium sulfate (mineral not specified)[e]	25,000	40,000	35,000	NA	NA
Sulfur:					
Native thousand tons	188	[e]188	[e]150	[e]75	70
Byproduct of petroleum and natural gas do	399	[e]400	[e]300	[e]200	150
Total do	587	588	[e]450	[e]275	220
Sulfuric acid do	260	260	[e]200	100	100
Talc	NA	400	[e]400	[e]400	300
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand tons	1,000	969	900	[e]900	700
Coke do	444	445	500	[e]400	400
Gas, natural:					
Gross million cubic feet	1,776,225	2,059,504	1,947,595	[e]1,100,000	NA
Marketed do	793,739	[e]795,000	687,397	[e]500,000	NA
Natural gas liquids:					
Propane thousand 42-gallon barrels	3,170	4,625	NA	NA	NA
Butane do	3,673	4,447	NA	NA	NA
Natural gasoline and other do	5,283	6,798	NA	NA	NA
Total do	12,126	15,870	[e]16,000	[e]500	NA
Petroleum:					
Crude[3] do	2,147,259	2,066,922	1,913,221	1,121,346	550,000
Refinery products:					
Gasoline:					
Aviation do	3,166	2,619	2,931	2,500	NA
Motor do	29,474	32,243	33,996	30,000	NA
Jet fuel do	8,857	11,995	11,038	10,000	NA
Kerosine do	32,815	34,425	31,638	30,000	NA
Distillate fuel oil do	49,629	56,960	50,705	45,000	NA
Residual fuel oil do	96,072	102,920	100,195	90,000	NA
Lubricants do	824	2,760	3,376	3,000	NA

See footnotes at end of table.

Table 1.—Iran: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other:					
Liquefied petroleum gas thousand 42-gallon barrels	4,184	4,629			
Naphtha and solvents do.	5,289	7,430			
Asphalt do.	5,215	NA	10,671	9,500	NA
Bitumen do.	NA	5,971			
Unspecified do.	3,075	604			
Refinery fuel and losses do.	16,783	11,483	4,336	4,000	NA
Total do.	255,383	274,039	248,886	[e]224,000	NA

[e]Estimated. [p]Preliminary. NA Not available.

[1]Data are for years beginning Mar. 21 of that stated, except those for natural gas, natural gas liquids, and petroleum, which are for regular calendar years. Table includes data available through June 15, 1981.

[2]In addition to the commodities listed, other types of crude construction materials (such as common clays, sand and gravel, and other varieties of stone) are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Excludes petroleum reinjected into fields.

Table 2.—Iran: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Chromium: Chromite	89,105	26,522	France 10,364; West Germany 7,915; Italy 5,500.
Copper:			
Ore and concentrate	17,221	9,300	All to Japan.
Metal including alloys, semimanufactures	--	51	All to United Kingdom.
Iron and steel metal:			
Scrap	1,158	7,500	Qatar 6,734; Japan 586.
Semimanufactures:			
Plates and sheets	--	87	West Germany 49; Pakistan 38.
Tubes, pipes, fittings	23	19	United Kingdom 18.
Castings and forgings, rough	--	17	All to United Kingdom.
Lead:			
Ore and concentrate	6,885	8,742	France 4,032; Belgium-Luxembourg 3,457.
Metal including alloys:			
Scrap	--	145	United Kingdom 115.
Unwrought	--	30	All to Saudi Arabia.
Semimanufactures	--	100	Do.
Silver metal including alloys and platinum-group metals, waste and sweepings value, thousands	--	$151	France $134; West Germany $17.
Zinc ore and concentrate	17,347	41,362	Japan 20,605; United Kingdom 8,000; Italy 7,504.
Other: Oxides, hydroxides, peroxides	--	3	All to United Kingdom.
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	--	5	United Kingdom 3; Saudi Arabia 2.
Cement	--	1	All to United Kingdom.
Clay products:			
Refractory	--	1	Do.
Nonrefractory	51	35	United Kingdom 33.
Diamond:			
Gem, not set or strung -- value, thousands	$125	$1,185	Belgium-Luxembourg $1,028.
Industrial do.	$20	$39	All to Belgium-Luxembourg.
Fertilizer materials:			
Crude, phosphatic	NA	11	All to Pakistan.
Ammonia	43,569	19,077	All to France.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$686	$1,358	United States $606; Switzerland $578.
Synthetic do.	--	$28	Saudi Arabia $18; Israel $10.
Salt	(3)	188	All to Qatar.

See footnotes at end of table.

Table 2.—Iran: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
NONMETALS —Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	17,120	18,496	Italy 16,265; Japan 1,851.
Worked	2	97	Japan 85.
Gravel and crushed rock	14,818	5,049	Saudi Arabia 4,003; Qatar 1,046.
Sulfur, elemental, other than colloidal	35,811	22,418	Pakistan 12,361; Tunisia 10,057.
Other: Halogens	--	7	All to Belgium-Luxembourg.
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural ---million cubic feet	454	20	All to Japan.
Petroleum:			
Crude or partly refined thousand 42-gallon barrels	[4]1,623,192	[4]878,555	Japan 170,855; United States 115,606; West Germany 84,940.
Refinery products:			
Gasoline ---do---	10,632	7,687	Japan 5,180; Netherlands 1,082; West Germany 677.
Kerosine ---do---	140	820	Spain 443; Singapore 262; Jordan 107.
Distillate fuel oil ---do---	567	624	Thailand 591.
Residual fuel oil ---do---	11,626	33,595	Japan 12,143; France 6,059; Republic of Korea 2,738.
Lubricants ---do---	NA	7,139	Singapore 7,014.
Other:			
Liquefied petroleum gas ---do---	5,994	3,106	Japan 1,728; United States 1,034.
Petroleum coke ---do---	1	1	All to Saudi Arabia.
Bitumen and other residues ---do---	2	1	Do.
Bituminous mixtures ---do---	--	(3)	All to United Kingdom.
Unspecified including bunkers do---	[4]39,658	27,145	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	60	789	Belgium-Luxembourg 518; Saudi Arabia 271.

NA Not available.

[1]Owing to the lack of available official trade data published by Iran, this table should not be taken as a complete presentation of Iran's mineral exports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[3]Less than 1/2 unit.

[4]Organization of Petroleum Exporting Countries. Annual Statistical Bulletin 1979, Vienna.

Table 3.—Iran: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Oxides and hydroxides	1,346	63	West Germany 36; Netherlands 18.
Metal including alloys:			
Unwrought	21,119	2	United States 1; United Kingdom 1.
Semimanufactures	32,144	9,164	Switzerland 2,665; West Germany 2,390; Italy 1,123.
Chromium oxides and hydroxides	12	1	All from United Kingdom.
Cobalt metal including alloys, all forms	--	4	United States 3; West Germany 1.
Copper metal including alloys:			
Scrap	9	40	All from United Kingdom.

See footnotes at end of table.

Table 3.—Iran: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Copper metal including alloys —Continued			
Unwrought	306	623	Belgium-Luxembourg 216; France 180; West Germany 153.
Semimanufactures	44,161	12,531	Japan 4,286; West Germany 3,384; Spain 1,200.
Iron and steel:			
Ore and concentrate	103	5	All from Netherlands.
Metal:			
Pig iron	14,105	367	Sweden 200; West Germany 88.
Ferroalloys	5,753	4,818	West Germany 4,713; Japan 85.
Steel, primary forms	985,903	315,582	Japan 230,352; West Germany 53,012; Australia 19,599.
Semimanufactures:			
Bars, rods, angles, shapes, sections	1,643,489	609,070	Spain 181,435; West Germany 112,876; Belgium-Luxembourg 96,679.
Plates and sheets	1,432,907	461,235	Japan 263,674; West Germany 66,819; Czechoslovakia 39,000.
Hoop and strip	81,726	25,516	Japan 16,076; West Germany 5,902.
Rail and accessories	20,361	14,146	Japan 9,427; France 3,043.
Wire	14,190	8,096	Japan 3,667; West Germany 1,550; Hungary 795.
Tubes, pipes, fittings	290,035	88,994	Japan 50,805; West Germany 8,464; United States 5,769.
Castings and forgings, rough	4,167	1,093	Japan 467; West Germany 287; Spain 150.
Lead:			
Oxides	297	160	Netherlands 150.
Metal including alloys:			
Unwrought	11,034	3,769	Australia 3,608;[3] United Kingdom 145.
Semimanufactures	843	26	Belgium-Luxembourg 10; Japan 8; United States 7.
Magnesium metal including alloys, all forms	98	20	United Kingdom 13; United States 7.
Manganese:			
Ore and concentrate	4,168	1,785	All from Netherlands.
Oxides	120	50	All from Japan.
Mercury 76-pound flasks	522	479	Do.
Molybdenum metal including alloys, all forms kilograms	--	431	Do.
Nickel metal including alloys:			
Unwrought	133	47	United Kingdom 32; United States 10.
Semimanufactures	167	117	United Kingdom 78; West Germany 27.
Platinum-group metals including alloys, unwrought or wrought value, thousands	$283	$593	West Germany $477; United Kingdom $60.
Silver metal including alloys, unwrought or wrought do	$6,226	$1,711	West Germany $1,102; Switzerland $449.
Tin metal including alloys:			
Scrap	--	64	All from United States.
Unwrought	302	263	Singapore 152; Malaysia 91.[3]
Semimanufactures	60	31	Japan 16; West Germany 10.
Titanium:			
Oxides	1,548	300	West Germany 127; Belgium-Luxembourg 117.
Metal including alloys, all forms	--	34	All from United States.
Tungsten metal including alloys, all forms	1	1	All from United Kingdom.
Zinc:			
Oxides and peroxides	176	374	United Kingdom 211; France 121.

See footnotes at end of table.

Table 3.—Iran: Apparent imports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Zinc —Continued			
Metal including alloys:			
Scrap	--	200	All from Belgium-Luxembourg.
Unwrought	10,985	1,951	Australia 800; Belgium-Luxembourg 650; West Germany 500.
Semimanufactures	560	486	United Kingdom 360; Australia 100.
Other:			
Oxides, hydroxides, peroxides	381	19,711	United Kingdom 19,700.
Metals:			
Metalloids	4,976	3,534	France 3,533.
Base metals including alloys, all forms, n.e.s	127	9	United Kingdom 4; West Germany 3.
NONMETALS			
Abrasives:			
Natural: Pumice, emery, natural corundum, etc	244	97	Netherlands 64; Italy 33.
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	$131	$653	Switzerland $650.
Grinding and polishing wheels and stones	1,848	912	West Germany 332; Japan 253.
Asbestos	--	1,757	Canada 1,194; Australia 522.
Boric oxide and acid	NA	322	Turkey 280.
Cement	1,689,807	290,881	Republic of Korea 218,000; Spain 38,454; Greece 17,500.
Chalk	2,413	883	France 631; Belgium-Luxembourg 213.
Clays and clay products:			
Crude	20,402	7,537	United Kingdom 6,184; West Germany 812.
Products:			
Refractory	20,859	8,345	West Germany 5,050; Japan 2,238.
Nonrefractory	32,570	2,856	Italy 2,294; United Kingdom 259.
Cryolite and chiolite	--	2	All from United Kingdom.
Diamond:			
Gem, not set or strung value, thousands	$1,754	$6,973	Belgium-Luxembourg $6,604.
Industrial value, thousands	$647	$158	All from United States.
Diatomite and other infusorial earth	891	329	United States 198; West Germany 127.
Feldspar and fluorspar	615	100	West Germany 50; Italy 50.
Fertilizer materials:			
Crude:			
Nitrogenous	--	62	All from United Kingdom.
Phosphatic	478,270	113,896	Morocco 83,396; Jordan 30,500.
Manufactured:			
Nitrogenous	14,543	34,790	Netherlands 18,588; Saudi Arabia 15,969.
Phosphatic	98	9,691	United States 9,539.
Potassic	4,997	10,505	Belgium-Luxembourg 10,500.
Other including mixed	39,716	751	West Germany 590; Switzerland 91.
Ammonia	1,549	72	West Germany 33; Netherlands 31.
Graphite, natural	871	81	West Germany 80.
Gypsum and plasters	1,829	1,449	West Germany 1,415.
Lime	1,557	599	United Kingdom 573.
Magnesite	2,494	736	Jordan 505; United Kingdom 204.
Mica:			
Crude including waste	64	15	All from United Kingdom.
Worked	--	1	All from Japan.
Pigments:			
Natural, crude	--	7	All from United States.
Iron oxides, processed	906	785	West Germany 415; Japan 155; United Kingdom 138.

See footnotes at end of table.

Table 3.—Iran: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Precious and semiprecious stones except diamond:			
Natural ---------- value, thousands	$530	$895	Switzerland $570; Thailand $208.
Synthetic ---------- do	$233	$50	Switzerland $49.
Salt	2,840	100	United Kingdom 42; West Germany 39.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	38,538	6,531	West Germany 4,299; Spain 1,000; United States 869.
Caustic potash	90	53	Belgium-Luxembourg 25; France 13; Portugal 13.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	149	124	Pakistan 90; Italy 34.
Worked	896	105	West Germany 71.
Dolomite	--	5	All from West Germany.
Gravel and crushed rock	1,691	2,098	United Kingdom 2,050.
Quartz and quartzite	480	78	Sweden 70.
Sand excluding metal bearing	8,902	1,803	West Germany 1,719.
Sulfur:			
Elemental:			
Colloidal	33	5	All from West Germany.
Other than colloidal	1,076	421	West Germany 223; France 198.
Sulfuric acid	560	109	Belgium-Luxembourg 35; United Kingdom 20; Netherlands 19.
Talc	448	123	Japan 83; West Germany 30.
Other:			
Crude	3,606	470	West Germany 311; United Kingdom 122.
Oxides and hydroxides of magnesium, strontium, barium	293	33	Italy 18; West Germany 12.
Halogens	41	3	Netherlands 2; France 1.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	40	20	All from West Germany.
Carbon black	1,161	463	West Germany 373; Italy 44.
Coal, anthracite and bituminous	83,150	51,115	West Germany 50,926.
Coke and semicoke	1,429	814	West Germany 714.
Peat and peat briquets	872	21	All from Sweden.
Petroleum refinery products:			
Gasoline ---------- 42-gallon barrels	80,393	672	Netherlands 570.
Kerosine ---------- do	243,939	14,508	Saudi Arabia 13,082.
Distillate fuel oil ---------- do	5,632	2,589	West Germany 2,477.
Residual fuel oil ---------- do	10,549	17,949	All from Greece.
Lubricants ---------- do	204,827	122,598	Netherlands 91,511; West Germany 13,181.
Other:			
Liquefied petroleum gas ---------- do	17,899	14,535	Italy 8,108; France 6,032.
Mineral jelly and wax ---------- do	8,035	6,044	West Germany 3,896; Japan 630.
Nonlubricating oils ---------- do	12,702	42	All from Japan.
Petroleum coke ---------- do	127,655	3,025	All from West Germany.
Bitumen and other residues ---------- do	6,793	473	West Germany 442.
Bituminous mixtures ---------- do	37,772	1,830	All from United Kingdom.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,608	2,680	Saudi Arabia 2,252; United Kingdom 146; France 126.

NA Not available.

[1]Owing to the lack of available official trade data published by Iran, this table should not be taken as a complete presentation of Iran's mineral imports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[3]Metallgesellschaft AG. Metal Statistik, Druckerei C. Adelmann, Frankfurt am Main, 1980.

COMMODITY REVIEW

METALS

Chromite.—The decline in output of chromite in recent years is substantial from a high of over 230,000 tons in 1977. The major portion of production has been derived from the southern area of Iran. Exports of a significant portion of production have gen-

erally been to Japan and Eastern Europe. In 1980, approximately 20,000 tons were reported exported to the U.S.S.R.[2]

Copper.—Iran's major copper development project at Sar Cheshmeh continued to be stalled. Begun in 1973, and estimated to cost $1.4 billion, the operation entailed development of a deposit estimated to contain 450 million tons of ore grading 1.13% copper. Most of the complex infrastructure requirement for the remote region was completed by yearend 1978, and ore production had begun, but work was suspended following withdrawal of foreign personnel because of the revolution. The Government reported that production would be 145,000 tons per year, with output destined solely for the domestic market.[3] Reliance was being placed on local industry to furnish equipment and service for the smelter, as well as for construction of the refinery.

Shipments of concentrates from the Minakan Mine in eastern Khorassan Province, mainly to Japan, were resumed in early 1980 following their interruption during the height of the revolution. Total production was 14,000 tons per year of concentrate.[4]

Iron Ore.—The extent of Iranian participation in the iron ore project at Kundremukh, India, continues to be uncertain, despite commitment of $630 million and the near startup of ore production. Output was originally slated for the Iranian iron and steel industry. However, other alternatives for marketing a portion of the ore are being explored as Iran has declared it intends to purchase only 4.5 million tons per year instead of the 7.5 million tons per year originally contracted.

Iron and Steel.—The Aryamehr Steel Plant of the National Iranian Steel Corp. (NISC) at Isfahan has a reported capacity of 1.5 million tons per year of crude steel. The plant was built with conventional technology under Soviet supervision. Production was less than half of capacity because of coal supply problems.[5]

The most recent plans for construction of a $1.5 billion steelworks near Isfahan by Italimpianti remain intact following renegotiation of the original contract. Source of iron for the plant is to be the deposit at Kudremukh, India, under joint development by both countries. However, ore from the Gol-e-Gowhar deposit in the Kerman area was also reported to be a possible source.[6]

NONMETALS

Phosphate Rock.—The French Bureau de Récherches Géologiques et Miniéres and its Iranian partner GEOMETAL continued work on a major contract for the National Petrochemical Co. The project involved detailed exploration of two specific areas in central Elburz and northeastern Zagros, as well as a technical-economic study of deposits already detected in southern Iran.

MINERAL FUELS

Coal.—Efforts were made to increase the supply of locally produced coal, particularly in the Kerman region, for use in the Isfahan Steel Plant of NISC. The Kerman Province deposit has been a good source of coking coal and, if blended with coal from other mines, may extend the supply of acceptable coking coals.

Natural Gas.—The new Government continued to emphasize development of ongoing natural gas projects primarily for domestic needs rather than for the export market. The Gevarzin Gas Processing Plant at Qeshm Island began operations in May with a capacity of 75 million cubic feet per day. A 12-inch gas pipeline extending 70 kilometers to Bandar Abbas to supply a 320-megawatt power station was also placed in operation.

Repair work neared completion in the Pars Field following an underground blowout that occurred in September 1977. Reserves of the natural gasfield were put at 54 trillion cubic feet.[7]

Exports of natural gas to the U.S.S.R. in early 1980 were reported at only 15% of the 10 billion cubic feet per year contracted. Associated gas from the Khuzestan Oilfields was shipped to the U.S.S.R. through the Iranian Gas Truckline (IGAT-1) pipeline. The two countries were renegotiating the price for the gas as well as the amount shipped. Iran claimed its gas requirements were increasing, particularly for reinjection to maintain pressure in the Khuzestan Oilfields. However, a landslide reportedly cut the pipeline in March and by April exports of gas to the U.S.S.R. were officially terminated, with all supply to be used internally.[8] By October, military operations between Iran and Iraq in the Khuzestan area jeopardized production from many of the major oilfields.

Petrochemicals.—Work was reported to again be underway on the long delayed petrochemical complex at Bandar Kho-

meini.[9] The project by the Iran Japan Petrochemical Co. was begun in 1973 at a cost of $500 million. Present cost for the complex is now put at $3.3 billion including $750 million in excess interest payments incurred during the revolution. In early 1980, delays reportedly were adding about $420,000 per day in interest payments and wages. The plant is to use flared gas from the Ahwaz and Marun Oilfields. Output is planned at 1.9 million tons of liquefied petroleum gas (LPG) plus 1 million tons of other products.

The Raze chemical complex increased production of urea to 19,150 tons in June. Output of 950 tons per day of sulfur and 800 tons per day of ammonia was also reported. Phosphorus production was expected to resume shortly using Moroccan phosphate rock in place of the U.S. supply.

Petroleum.—Production and exports of crude petroleum stabilized for a brief period in early 1980 following nearly a 50% reduction between 1978 and 1979. In late March insurgent action cut the supply of 15,000 barrels per day of crude oil to the Kermanshah refinery as well as severing seven oil and gas pipelines supplying the Abadan refinery. Output at the refinery was cut from 580,000 barrels per day to 395,000 barrels per day. Military clashes with Iraq occurred sporadically during this time. Losses of traditional export markets for Iranian crude and refined products following the imposition of economic sanctions by the United States and other countries resulted in major changes in production policy and severe inbalances in fuel supply. Storage tanks were filled with unusable residual fuel while lighter fuels were used internally. In late September, open conflict with Iraq placed the country in a state of war, with many petroleum and gas installations and pipelines being damaged or destroyed. By mid-October both the Abadan and Tabriz refineries with capacities of 700,000 and 80,000 barrels per day, respectively, were considered totally inoperative. The Abadan refinery accounted for 70% of all product output for Iran. The Kermanshah refinery also was inoperative. The recently completed Isfahan refinery with a capacity of 100,000 barrels per day and the Shiraz refinery with a throughput of 40,000 barrels per day were believed still operational at yearend. The Teheran refinery was reported damaged and operating below its 275,000-barrel-per-day capacity.[10] Offloading facilities at Kharg Island were severely damaged, but at yearend Iran was offering crude at the terminal at reduced rates.[11]

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[1]Physical scientist, Branch of Foreign Data.
[2]Business Week. Moscow's Ominous Shift Toward Buying Minerals. No. 2654, Sept. 8, 1980, p. 58.
[3]Mining Journal (London). Sar Cheshmeh Copper Exclusively for Domestic Market. V. 294, No. 7534, Jan. 11, 1980, p. 26.
[4]Metal Bulletin (London). Iran Still Ships Copper Concs. No. 6477, Mar. 28, 1980, p. 20.
[5]American Metal Market. Conflict Yet to Affect Iran Mill Construction. V. 86, No. 188, Sept. 26, 1980, p. 4.
[6]Metal Bulletin (London). Iran Project to Go Ahead. V. 6440, Nov. 13, 1979, p. 36.
[7]The Financial Times (London). Gas Field Repairs Nearing Completion. No. 28,302, Oct. 23, 1980, p. 4.
[8]Middle East Economic Survey (Cyprus). Oil Ministry Orders Halt to IGAT Gas Exports. V. 23, No. 26, Apr. 14, 1980, p. 2.
[9]U.S. Embassy, London, Great Britain. State Department Telegram T-22255, Oct. 21, 1980, p. 2.
[10]Petroleum Economist (London). Oil Installations Badly Damaged. V. 47, No. 11, November 1980, p. 464.
[11]Middle East Economic Survey (Cyprus). Iran Offering Crude at Kharg at $28 Barrel. V. 24, No. 11, Dec. 29, 1980, p. 6.

The Mineral Industry of Iraq

By Suzann C. Ambrosio[1]

The petroleum sector continued to dominate the mineral industry in Iraq. Despite the interruptions caused by the Iran-Iraq war, Iraq remained the second largest Middle East crude oil producer and exporter after Saudi Arabia. Iraqi crude oil output of roughly 3.2 million barrels per day, represented approximately 4% of the world's total production during 1980. Crude oil exports reached approximately 2.2 million barrels per day and represented nearly 8% of the 1980 oil exports of the market-economy countries.

Petroleum accounted for over 99% of Iraq's total export bill during 1980. Oil revenues were estimated to approach $30 billion, and the total import bill was estimated at $14.6 billion.[2] The country's overall trade balance increased nearly 30% over the 1979 balance to approximately $15 billion.

Iraq's gross national product was projected to grow at an average annual rate of 16.6% over the period (1976-80) of the 5-year plan. When oil exports were halted late in the year, Government officials announced that the economy could be sustained for an entire year without oil revenues, utilizing gold and foreign exchange reserves. The country's reserves were estimated to exceed $20 billion by yearend 1980. The strength of the economy lies primarily with petroleum reserves; however, the growing agricultural and industrial sectors have made increasing contributions. Major obstacles which have impeded economic development included lack of a skilled workforce and insufficient infrastructure. Economic growth stagnated during the war because most of the million expatriate technicians departed.

The war also delayed oil exploration and drilling projects. Mobil Corp. was conducting advanced seismic tests just west of Baghdad during 1980. The analyses indicated the presence of a huge oil reservoir, which could potentially double Iraq's production capacity by 1990. Mobil, Exxon Corp., and two French oil companies were expected to resume their investigations early in 1981.

The Iraqi Government continued to get involved in all phases of the petroleum industry. Plans were underway to develop the Majnoon, Nahr Umr, Halfayah, Ghart al-Qurnah, and Baghdad oilfields. In December 1979, Iraq's National Oil Co. (INOC) acquired Braspetro's (Brazil) holdings of the first two fields, thereby acquiring control over all the country's operating and most promising petroleum fields.

In July of 1980, the Iraqi Revolutionary Command Council (RCC) organized a Supreme Technical Authority to supervise all phases of new oil development projects. In addition, a Projects Development Department was created within INOC and was given ultimate delegation and implementation authorities over the new oilfields. The RCC set up the General Establishment for Liquefied Petroleum Gas, affiliated to Iraq's State Corp. for Oil Projects (SCOP), which is expected to operate and manage the refineries and associated facilities for the Northern and Southern gas projects.

Iraq declared force majeure late in September 1980, thereby legally excusing the country from previously signed contracts. The Iran-Iraq war escalated from the cancellation of the 1975 Shatt al Arab border accord with Iran, to heavy ground force movements in the southern two-thirds of the border and air raids in the mountainous northern border between the two countries. Iraq's oilfields near Kirkuk, Mosul, and Basrah were repeatedly attacked. Kirkuk pumping stations and the Kirkuk-Dortyol

pipeline were damaged. Oil export terminals on the Persian Gulf at Fao, Mina al-Bakr, and Khor al-Amaya were reported to be heavily damaged. The Basrah and Daura petroleum refineries were also attacked. War damages were assessed in November 1980, and repair costs were estimated at $3 to $4 billion. Most of Iraq's petroleum exports were halted by yearend 1980. Trade patterns were changed, and the Jordanian Port of Aqaba became Iraq's vital link to the rest of the world.

PRODUCTION AND TRADE

Crude oil output declined by approximately 25% during 1980; however, the value of exports increased by approximately 23% over exports of the previous year. Production capacities were increased for natural gas facilities and other crude petroleum refineries. Iraq's domestic market required nearly 10% of the oil produced and 100% of the refined products. Contracts were signed to expand petroleum products for domestic consumption and export markets. Natural gas refining and petrochemical industries were expected to play an increasing role in Iraq's trade.

In the nonfuel mineral sector, production and exports increased in the sulfur and fertilizer industries. Expanded facilities and the achievement of greater production efficiences were largely responsible for the growth in output. Production of cement and steel was increased, and therefore less imports were required to meet domestic needs. These trends were expected to continue, and the Government set objectives to triple cement and quadruple steel output.

The volume of trade between the United States and Iraq, although relatively small, continued to increase. The value of U.S. exports increased by 34% in 1979 and were projected to exceed that level during 1980. The renewed oil supply contracts fixed the volume, and prices were deemed subject to change. The U.S. trade deficit with Iraq was projected to reach approximately $500 million by yearend 1980.

Table 1.—Iraq: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979[p]	1980[e]
Cement, hydraulic thousand metric tons	2,728	3,170	4,600	5,100	5,300
Gas, natural:					
Gross million cubic feet	380,000	[e] [3]370,802	[e] [3]388,460	560,000	430,000
Marketed[4] do.	74,408	56,502	60,035	78,751	79,000
Gypsum[e] thousand metric tons	160	160	160	160	160
Iron and steel: Crude steel metric tons	--	--	50,000	352,000	350,000
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	[e]960	1,200	[e]1,250	1,250	NA
Propane and butane do.	[e]1,700	2,500	[e]3,000	3,000	NA
Nitrogen: N content of ammonia thousand metric tons	[e]135	136	181	450	450
Petroleum:					
Crude thousand 42-gallon barrels	881,621	857,093	935,130	1,252,000	961,000
Refinery products:					
Gasoline do.	5,549	8,103	12,254	[e]13,000	NA
Jet fuel do.	1,341	4,708	1,935	[e]2,000	NA
Kerosine do.	3,490	--	5,160	[e]5,800	NA
Distillate fuel oil do.	8,432	8,541	12,899	[e]12,900	NA
Residual fuel oil do.	8,568	9,417	14,189	[e]15,000	NA
Lubricants do.	372	390	580	[e]600	NA
Other do.	7,360	9,344	13,609	[e]14,200	NA
Refinery fuel and losses do.	2,130	8,444	3,870	[e]4,000	NA
Total do.	37,242	48,947	64,496	[e]67,500	NA
Salt thousand metric tons	[e]64	82	82	90	90
Sulfur, elemental:					
Native, Frasch do.	582	620	600	550	600
Byproduct[e] do.	40	40	40	70	60
Total do.	622	660	640	620	660

[e]Estimated. [p]Preliminary. NA Not available.

[1]Includes data available through July 16, 1981.

[2]In addition to the commodities listed, lime and a variety of crude construction materials (clays, stone, and sand and gravel) are also produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels. In addition, limited, unreported quantities of phosphate rock may have been produced for test purposes prior to inauguration of commercial production at the Al-Qaim chemical complex.

[3]Reported as estimated.

[4]Includes reinjected, if any.

COMMODITY REVIEW

METALS

Iron and Steel.—The Khor Al Zubair steelworks operated near capacity of 400,000 tons per year during 1980. Creusot Loire (France) was nearing the completion of the semi-integrated steelworks and it expanded installations by yearend 1980. The steel complex was to include two HyL direct-reduction units, with capacities of 1,467 tons per day and 2,500 tons per day, respectively, a melting shop with four UHP electric-arc furnaces feeding 80% sponge iron and 20% scrap, and two 6-strand curved-mold continuous casters. The total carbon steel production capacity was designed at 440,000 tons per year. Billets were to be cast at 80, 100, 120, and 150 millimeters. The rolling mills consisted of two walking beam reheating furnaces with average capacities of 50 tons per hour, a 17-strand merchant bar mill, and a 4-strand medium section mill.[3] A raw materials handling installation was constructed for iron imports. The berth located at Um Kasr was designed to accommodate bulk carriers with a maximum of 100,000 tons.

NONMETALS

Cement.—Iraq's cement industry set a production capacity goal at 9 million tons per year for 1980. Although approximately a 7-million-ton-per-year capacity was achieved, contracts were signed to add another 3 million tons during the year. Two Japanese companies, Kawasaki Heavy Industries and Marubeni Corp., won contracts worth $230 million to construct cement factories at Al Tamin and Hit, near Baghdad. The cement plants were expected to produce approximately 2 million tons per year by yearend 1982. Fives-Cail Babcock, a French construction company, was expected to build a dry-process cement production line for the existing Badoosh plant near Mosul. The facility was expected to add 3,200 tons per day to production capacity by 1983, at a cost of $150 million.

Fertilizer Materials.—*Nitrogenous.*— The Khor Al Zubair fertilizer complex was comprised of two main units for the production of 2,000 tons per day of ammonia, 3,200 tons per day of urea, and 419,000 cubic meters of carbon dioxide. The first phase of the complex was completed late in 1979. The second phase was expected to be completed within the decade and add two more ammonia and urea processing units.

Iraq's State Organization for Minerals (SOM) considered constructing an ammonia plant for the Al Qaim fertilizer complex, which would require ammonia for ammonium phosphate and other complex fertilizers. A small, 150-ton-per-day skid-mounted ammonia facility was expected to be installed downstream from the Al Qaim plant. Natural gas for the ammonia production was expected to be supplied by Kirkuk. The entire complex was slated for completion by 1983.

Phosphorous.—The Akashat phosphate rock mine and the Al Qaim fertilizer complex with production capacities of 3.4 million tons per year and 1.1 million tons per year respectively, were nearing completion by yearend 1980. Syndicate Belge d'Enterprises a l'Etrange, 44% owned by Belgium and 56% owned by SOM, continued construction on the complex. The facility was designed to produce phosphoric acid, sulfuric acid, triple superphosphoric acid, and fertilizer products.

Salt.—The construction of a salt production complex in southern Iraq continued through 1980. The project was expected to supply 525,000 tons per year of industrial salt and 75,000 tons per year of packaged table salt for domestic consumption by yearend 1981.

Sulfur.—Sulfur was produced at an average 70% capacity from the Mishraq mines, and at an average 35% capacity from the Kirkuk natural gas desulfurization units during 1980. Despite the war and subsequent declines in output, production continued to exceed domestic demands. Increased consumption was expected to occur when the Basrah petrochemical refinery and as the Akashat-Qaim fertilizer complex were completed. Over the next 2 years, sulfur exports were expected to decline because roughly 500,000 tons of sulfuric acid would be diverted into fertilizer and petrochemical production.

In 1980, SOM signed a $49 million contract with a Japanese firm to construct a sulfur recovery unit near the Kirkuk refinery and a sulfuric acid plant at Mishraq. Contaminated sulfur from Mishraq's sulfur extraction process was expected to be refined by a recovery unit with a 150,000-ton-per-year capacity. The sulfuric acid plant was expected to have a capacity of 60,000 tons per year. The Mishraq Mine was in the process of becoming an integrated sulfur complex through the expansion of products,

to sulfuric acid, powdered sulfur, and alum.

MINERAL FUELS

Natural Gas.—Iraq continued to flare approximately 80% of the natural gas produced in association with crude petroleum. Small quantities of petroleum were refined into butane and propane, and marketed as liquefied petroleum gases (LPG). Total LPG plant capacity was approximately 4.3 billion barrels per year in 1979. The Oil Refineries Administration (ORA) and SCOP continued to operate refining facilities at Zubair, Basrah, and Kirkuk. During 1980, LPG units were added to the Daura refinery, and a $120 million gas liquefaction plant was completed at Zubair. In addition, a natural gas liquids (NGL) plant, which recovers the gas from various processing, pipeline, and dehydration plants, was completed at Rumaila.

Contracts continued to be awarded, and construction was initiated for the large gas-gathering and production schemes in the northern and southern regions of Iraq. The two natural gas projects undergoing construction during 1980 were targeted for different markets—domestic consumption in the north, and fertilizer production and exports in the south.

Mitsubishi Corp. and Mitsubishi Heavy Industries (Japan) won a $214 million turnkey contract for the Northern Gas Project. Compressors and fractionator facilities were expected to be provided with capacities of 2.8 million cubic feet per day. Ingeco Laing (Switzerland) subcontracted $16.5 million worth for distillation and ancilliary equipment. Toyo Engineering (Japan) was preparing the overall engineering design, and India's Dodsal was expected to lay 400 kilometers of gas-gathering and transmission lines for the project. Approximately 15 million barrels per year of LPG were expected to be processed in Kirkuk and distributed to Baghdad and other northern Iraqi cities.

Rapid development of the Rumaila oilfields allowed for a 30% expansion of the original Southern Gas Project contract that was signed in 1978. The new plant was expected to produce approximately 4 million tons per year of propane and butane and 1.5 million tons per year of condensate. Snamprogetti (Italy) was expected to handle the basic engineering design. Technip (France) was expected to construct a $240 million gas liquefaction plant at Zubair near Basrah. Nuovo Pigone (Italy) was awarded a $200 million contract for the construction of a gas-processing plant at Basrah and associated gas-gathering centers. Chiyoda and Mitsubishi (Japan) were awarded a $138 million turnkey contract to construct the NGL fractionator plant in Baiji. Toyo Engineering (Japan) was expected to build the LPG export terminal at Khor al-Zubair at a cost of $72 million. The entire southern gas project was expected to be completed in 1982.

Petroleum.—Proven oil reserves were estimated at 30 billion barrels in 1980. Crude oil production capacity was rated at over 4 million barrels per day, and the total oil refinery capacity was projected to reach 200,000 barrels per day. Actual crude oil output was reported between 3 and 3.5 million barrels per day through August 1980. There were approximately 250 producing wells for most of the year. Iraq's major operating and projected oilfields are shown in the following tabulation:

Table 2.—Major oilfields in Iraq, 1980[1]

Oilfield	Capacity[e] (millions of barrels per day)	Discovery date[2]	API gravity	Depth (feet)
Kirkuk	1.45	1927	36.0	2,800-4,200
Northern Rumaila and Rumaila.	.90	1958 (1972)	34.0	10,000-10,800
Zubair	.55	1949	34.2	11,000
Laheis	.51	(1978)	NA	NA
Bai Hasen		1953	34.0	4,800-5,400
Jambur	.30	1954	38.0	5,500-12,500
Abu Ghurab:				
Buzurgan and Jabal Faugui.	.20	(1976)	27.7	NA
Majnoon:				
Phase 1	.35	(1982)	NA	NA
Phase 2	.75	(1983)	NA	NA

[e]Estimated. NA Not available.
[1]Based on published figures prior to the Iran-Iraq war.
[2]Startup date is in parentheses.

Refining.—Prior to the war in 1980, ORA operated seven refineries. The total distillation capacity was approximately 170,000 barrels per day. Compared with the other oil-producing Middle East countries, Iraq represented a small fraction equivalent to 4% of the area's combined refining capacities. Plans were made to expand the refineries in order to supply domestic transport and the growing demands of commercial industries for middle distillates.

Construction continued on the Baiji plant, which was expected to add 220,000 barrels per day to existing capacity. Phase 1 of the Baiji project was expected to contribute 70,000 barrels per day by 1981. Snamprogetti won the contract for the engineering design and Czechoslovavia's Technoexport and Chemoprojekt were contracted for phase 1. Mitsubishi and Chiyoda won the $283 million contract for Baiji phase 2, which was expected to add 150,000 barrels per day by mid-1983. Another contract was signed during 1980 between SCOP and Snamprogetti for a 4,800-barrel-per-day lubricating oil plant at Baiji. The same company was nearing the completion of a $138 million, 1,900-barrel-per-day lubricating oil plant at Basrah.

Petrochemicals.—Lummus (Netherlands) won the contract for a $1 billion, 700,000 ton-per-year petrochemical complex in Basrah. The plant was expected to produce 150,000 tons per year of polyvinyl chloride, 135,000 tons per year of ethylene, 40,000 tons per year of caustic soda, and small amounts of other assorted organic chemicals.

Iraq's Ministry of Mines, Industry of Minerals, signed a technical assistance agreement with Norway's Saga Petrokjemi during 1980. The contract called for Iraqi technicians to be trained at Saga's Bamble petrochemical plant in Norway. The initial group of Iraq technicians were expected to supply a skilled workforce for the Basrah complex. Startup for the Basrah petrochemical facility was projected for 1981; however, the plant site was heavily bombed in September 1980.

Pipelines.—Iraq had a network of oil and gas pipelines connecting the major oil producing areas of Kirkuk, Zubair, and Bai Hasan. Because Iraq had approximately 50 miles of navigable coastline and therefore limited access to the Persian Gulf, pipelines were built to link the Kirkuk fields to the Mediterranean across Syria, and from the Port of Fao in southern Iraq to the Mediterranean, via Turkey. Iraq's pipeline system included a two-way, reversible flow, north-south pipeline which was designed to deliver up to 1 million barrels per day of Kirkuk crude southwards to the gulf terminals or approximately 900,000 barrels per day of Basrah crude northwards to the Mediterranean export terminals. An alternative route to the Mediterranean was provided with the commissioning of the newest line in 1978, from Kirkuk to Turkey's Port of Ceyhan.

Prior to the damages incurred by the Iran-Iraq war, throughput via the trans-Turkey pipelines was near capacity at 650,000 barrels per day. The trans-Syrian pipeline, with a designed capacity of 1.4 million barrels per day, was closed in 1976 because of transit fee disputes. However, the pipeline was briefly reopened in 1980 to accommodate Iraq's oil exports. During brief periods in November and December 1980, an estimated maximum of 1.2 million barrels per day could be exported through the Mediterranean ports. Oil exports through the gulf had ceased altogether during the initial weeks of the war.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Iraqi dinars(ID) to U.S. dollars at the rate of ID1 = US$3.3862.

[3]Metal Bulletin Monthly (London). United Kingdom. March 1980, p. 16.

The Mineral Industry of Ireland

By William F. Keyes[1]

The Irish economy was affected by the general economic slowdown in its major trading partners, and the gross national product was expected to reach only about $16 billion, or a 1% growth over 1979, allowing for inflation of about 15%. Mining and mineral production grew faster than the economy, however, as a major zinc-lead mine came into full production, and expansion continued in peat, natural gas, and the small coal industry. Difficulties, largely consisting of labor disputes, continued to plague the aluminum, nitrogen, and other industries.

The Minerals Development Act, 1979, was passed late in 1979, repealing certain sections of the Minerals Development Act, 1940. The purpose of the new act was to eliminate the deterrent posed to new exploration by uncertainties over mineral rights.

The major feature of the 1979 act was the vesting, in the Minister for Industry, Commerce, and Energy, of the "exclusive right of working minerals." (Hydrocarbons are excluded and are covered by the Petroleum and Other Minerals Development Act, 1960, which vests petroleum—liquid and gaseous hydrocarbons—in the Minister.) The act does not mention the controversial problem of ownership and does not apply to persons who were lawfully working mines prior to December 15, 1978. Provisions were made for these parties to register their minerals as "excepted." Such registration may be canceled if deposits are underworked or not worked at all. If the Minister does not exercise his right to work a mineral deposit covered by the act, he is empowered to grant a license to work it to another party. In such cases, the Minister must give advance public notice of his intention and take into account the views of interested individuals. When the Government exercises its rights under the new act, the Minister is obliged to publicly notify persons entitled to compensation and to pay such compensation. The act provides an appeal process in case of disputes, as well as general guidelines for assessing fair compensation.

In practice, almost all mining in Ireland has been done by private corporations, including a number of non-Irish corporations. Hydrocarbon exploration has been conducted by a number of non-Irish firms, including an American firm that found the only commercially exploitable natural gasfield yet discovered; several American firms were currently searching for oil in Irish offshore waters.

PRODUCTION

Production of minerals in 1978, 1979, and 1980 is given in table 1.

Table 1.—Ireland: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Copper, mine output, metal content	4,100	4,900	4,800	4,900	4,200
Iron and steel: Crude steel thousand tons	88	47	69	72	28
Lead, mine output, metal content	32,600	41,000	47,800	71,000	59,000
Silver, mine output, metal content thousand troy ounces	925	936	631	1,059	772
Zinc, mine output, metal content	62,800	116,300	176,000	212,300	228,700
NONMETALS					
Barite	323,000	373,000	349,000	328,300	259,947
Cement, hydraulic thousand tons	1,569	1,580	1,806	2,067	1,838
Gypsum do.	355	342	392	417	382
Lime	69,000	80,000	92,000	73,000	31,700
Nitrogen: N content of ammonia thousand tons	35	28	24	171	254
Pyrite	65,000	47,000	42,000	29,354	25,000
Sand and gravel[3] thousand tons	5,770	5,464	5,726	7,168	5,376
Stone and other quarry products:					
Limestone[3] do.	7,292	8,755	11,147	11,101	11,945
Other[3 4] do.	2,829	3,068	3,396	4,280	3,694
Sulfur: S content of pyrite	31,000	r21,150	18,900	13,050	11,250
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite and bituminous thousand tons	49	54	31	62	63
Coke, gashouse, including breeze do.	33	e33	NA	341	40
Peat:					
For agricultural use do.	71	83	82	90	88
For fuel use:					
Sod peat[5] do.	1,834	2,015	1,974	1,627	1,688
Milled peat[6] do.	3,813	3,085	2,630	1,981	2,738
Total do.	5,647	5,100	4,604	3,608	4,426
Peat briquets[7] do.	308	351	334	320	338
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	3,528	4,219	4,508	4,412	4,152
Jet fuel do.	160	606	98	252	155
Distillate fuel oil do.	3,812	4,585	4,821	4,566	4,019
Residual fuel oil do.	5,714	6,622	6,388	7,075	5,981
Other:					
Liquefied petroleum gas do.	602	695	719	260	238
Naphtha do.	216	207	121	126	35
Refinery fuel and losses do.	341	263	206	574	408
Total do.	14,373	17,197	16,861	17,265	14,988

eEstimated. pPreliminary. rRevised. NA Not available.

[1]Table includes data available through Aug. 24, 1981.

[2]In addition to the commodities listed, substantial quantities of stone and sand and gravel are produced by local authorities and road contractors. In 1976, the latest year for which such data are available, this output included 418,650 tons of sand and gravel, 193,779 tons of limestone, and 260,788 tons of various other stones. Ireland also produces significant quantities of manufactured diamond, but output is not quantitatively reported, and available general information is inadequate to make reliable estimates of output levels.

[3]Excludes output by local authorities.

[4]Figures given as reported in source; includes granite, marble, silica rock, sand, calcspar, fire clay, and slate and clays for cement production.

[5]Includes production by farmers and by Bord Na Mona.

[6]Includes milled peat used for briquet production.

[7]Produced from milled peat shown separately.

TRADE

Irish trade in minerals for the 2 most recent years is given in tables 2 and 3. As a member of the European Communities (EC), Ireland has an active mineral trade with other EC members and the United States. This trade consists, to a large extent, of imports of finished products, and exports of concentrates and semifinished minerals.

Table 2.—Ireland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Hydroxide	1,752	1,577	--	United Kingdom 385; France 311.
Metal including alloys:				
Waste and scrap	840	2,151	--	United Kingdom 1,417; Netherlands 299.
Unwrought	2,325	2,523	--	United Kingdom 2,146.
Semimanufactures	1,407	2,099	--	United Kingdom 1,165.
Copper:				
Ore and concentrate	25,002	17,703	--	Spain 7,391; Belgium-Luxembourg 4,260.
Metal including alloys:				
Waste and scrap	5,869	5,910	--	United Kingdom 1,641; Belgium-Luxembourg 1,310; West Germany 1,290.
Unwrought	359	253	NA	NA.
Semimanufactures	1,827	2,569	458	United Kingdom 1,014.
Iron and steel:				
Ore and concentrate	r37,352	31,160	NA	NA.
Metal:				
Waste and scrap	54,100	40,991	--	United Kingdom 16,206; Spain 10,605; Denmark 5,930.
Pig iron, ferroalloys, similar materials	115	95	NA	NA.
Steel, primary forms	3,678	437	--	United Kingdom 103.
Semimanufactures	56,374	25,281	--	United Kingdom 19,046.
Lead:				
Ore concentrate	69,175	115,276	--	France 44,656; West Germany 23,595; Belgium-Luxembourg 20,637.
Oxides	7	NA	NA	NA.
Metal including alloys:				
Waste and scrap	1,976	954	--	Belgium-Luxembourg 194.
Unwrought	3,231	3,196	--	United Kingdom 3,161.
Semimanufactures	1,007	1,438	--	United Kingdom 1,342.
Manganese:				
Ore and concentrate	19	18	NA	NA.
Oxides	11,831	NA	NA	NA.
Mercury 76-pound flasks	3	3	NA	NA.
Nickel metal including alloys:				
Waste and scrap	22	23	NA	NA.
Unwrought and semimanufactures	r145	140	--	West Germany 57; Switzerland 45.
Platinum-group metals including alloys, unwrought and partly wrought troy ounces	14,178	3,826	--	United Kingdom 3,376.
Silver metal including alloys, unwrought and partly wrought do.	77,290	43,628	--	United Kingdom 41,700.
Tin metal including alloys, all forms	r107	71	NA	NA.
Titanium oxides	20	NA	NA	NA.
Zinc:				
Ore and concentrate	344,426	413,872	--	Belgium-Luxembourg 158,834; France 68,385; West Germany 51,020.
Oxides and peroxides	73	NA	NA	NA.
Metal including alloys:				
Waste and scrap	186	202	NA	NA.
Unwrought and semimanufactures	377	329	NA	NA.
Other:				
Ash and residue containing nonferrous metals	932	2,201	--	West Germany 225.
Waste and sweepings of precious metals value	$520,049	$710,517	--	United Kingdom $630,661.
Oxides, hydroxides, pentoxides	2	1 10	NA	NA.
Metal:				
Metalloids kilograms	300	--		
Alkali, alkaline, and rare-earth metals	(2)	7	NA	NA.
Base metals including alloys, all forms	316	115	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural, crude	4	43	NA	NA.
Artificial corundum	--	8	NA	NA.
Grinding and polishing wheels and stones	81	118	38	United Kingdom 33; West Germany 15.
Asbestos	571	302	NA	NA.
Barite and witherite	322,853	302,317	145,716	Norway 33,092; United Kingdom 27,031.
Boron materials	27	20	NA	NA.
Cement	104,900	133,649	--	United Kingdom 131,440.

See footnotes at end of table.

Table 2.—Ireland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Chalk	1	--		
Clays and clay products:				
Crude clays	r238	194	NA	NA.
Products:				
Refractory including nonclay brick	59,071	60,243	--	United Kingdom 17,673; West Germany 8,764; Belgium-Luxembourg 6,713.
Nonrefractory	1,400	1,613	NA	NA.
Diamond, industrial carats	150,000	--		
Diatomite	6	2	NA	NA.
Fertilizer materials:				
Crude:				
Phosphatic	5	150	NA	NA.
Other including mixed	382	635	NA	NA.
Manufactured:				
Nitrogenous	5,910	144	NA	NA.
Phosphatic	1,081	575	NA	NA.
Other including mixed	47,798	17,631	--	United Kingdom 17,188.
Ammonia	16	62,921	--	Spain 23,040; United Kingdom 22,374.
Graphite, natural	114	--		
Gypsum and plasters	r66,123	57,184	--	United Kingdom 27,295.
Lime	2,549	2,985	NA	NA.
Magnesium materials	51,146	35,901	33,861	Italy 951.
Mica, crude, including splittings and waste	--	46	NA	NA.
Pigments, mineral, including processed iron oxides	23	NA	NA	NA.
Salt	22	233	NA	NA.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	57	536	NA	NA.
Caustic potash, sodic and potassic peroxides	39	29	NA	NA.
Soda ash kilograms	500	6,530	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	621	1,290	NA	NA.
Worked	693	425	--	United Kingdom 149.
Dolomite	5	1	NA	NA.
Gravel and crushed rock	295,172	272,442	--	West Germany 232,444.
Limestone excluding dimension	25	387	NA	NA.
Quartz and quartzite	170	84	NA	NA.
Sand excluding metal-bearing	2,538	5,376	NA	NA.
Sulfur:				
Elemental:				
Colloidal	--	18	NA	NA.
Other than colloidal	8	2,901	NA	NA.
Sulfuric acid	5,765	3,596	NA	NA.
Talc, steatite, soapstone, pyrophyllite	3	19	NA	NA.
Other:				
Crude	15	4	NA	NA.
Slag, dross, and similar waste, not metal-bearing	39	3	NA	NA.
Oxides, hydroxides, peroxides of magnesium, strontium, barium	367	425	NA	NA.
Bromine, fluorine, iodine	38	24	NA	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	18,809	14,301	--	United Kingdom 11,819.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	37	8	NA	NA.
Carbon black	659	509	--	Netherlands 270.
Coal, anthracite and bituminous including briquets	57,945	65,760	--	United Kingdom 62,193.
Coke and semicoke	25,948	17,352	--	Sweden 16,352.
Hydrogen, nitrogen, oxygen, rare gases	646	808	NA	NA.
Peat including briquets and litter	158,116	145,355	--	United Kingdom 117,104.
Petroleum refinery products:				
Gasoline 42-gallon barrels	4,862	7,948	NA	NA.
Kerosine do	23	140	NA	NA.
Distillate fuel oil do	60	2,835	NA	NA.
Residual fuel oil do	191,895	576,616	NA	NA.

See footnotes at end of table.

Table 2.—Ireland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products —Continued				
Lubricants 42-gallon barrels	54,082	39,158	--	United Kingdom 37,646.
Other:				
Liquefied petroleum gas do	r14,349	36,505	--	United Kingdom 30,949.
Mineral jelly wax do	1,684	1,472	--	United Kingdom 551; Netherlands 354.
Bitumen and other residues do	164	3,703	NA	NA.
Bituminous mixtures do	321	582	NA	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	128	384	NA	NA.

rRevised. NA Not available.
1Excludes quantity valued at $14,085,440.
2Less than 1/2 unit.

Table 3.—Ireland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	r1	--		
Oxides and hydroxides	r3,239	3,536	NA	United Kingdom 2,899.
Metal including alloys:				
Waste and scrap	441	360	NA	NA.
Unwrought	6,333	7,888	--	United Kingdom 4,942; Norway 1,575.
Semimanufactures	14,098	15,037	1,548	United Kingdom 9,256; West Germany 1,333.
Chromium oxides and hydroxides	87	--		
Cobalt oxides and hydroxides kilograms	1,200	--		
Copper:				
Ore and concentrate	1	--		
Matte	--	19	NA	NA.
Metal including alloys:				
Waste and scrap	95	35	NA	NA.
Unwrought	161	148	--	United Kingdom 129.
Semimanufactures	15,746	16,543	134	United Kingdom 11,604; Belgium-Luxembourg 997.
Iron and steel:				
Ore and concentrate	--	77	NA	NA.
Metal:				
Waste and scrap	9,051	5,428	--	United Kingdom 2,144.
Pig iron, cast iron, spiegeleisen	1,345	1,352	NA	NA.
Sponge iron, powder, shot	964	1,660	--	United Kingdom 1,597.
Ferroalloys:				
Ferromanganese	990	577	NA	NA.
Ferrosilicon	494	408	NA	NA.
Other	110	66	NA	NA.
Steel, primary forms	17,004	13,257	--	United Kingdom 8,384; West Germany 762.
Semimanufactures:				
Bars, rods, angles, shapes, sections	143,594	192,185	--	United Kingdom 125,362.
Universals, plates, sheets	r154,502	182,376	--	United Kingdom 91,630; West Germany 21,689; France 14,919.
Hoop and strip	14,418	25,920	--	United Kingdom 17,240; West Germany 4,142.
Rails and accessories	15,334	11,876	--	United Kingdom 5,363.
Wire	11,139	12,355	--	United Kingdom 6,396; France 2,063; Belgium-Luxembourg 1,741.
Tubes, pipes, fittings	59,132	74,981	401	United Kingdom 39,098; Netherlands 4,462; West Germany 3,882.
Castings and forgings, rough	3,068	2,916	--	Italy 1,150; United Kingdom 649.
Lead:				
Oxides	2,421	NA	NA	NA.

See footnotes at end of table.

Table 3.—Ireland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Lead —Continued				
Metal including alloys:				
Waste and scrap	2,974	3,906	--	United Kingdom 2,770; Netherlands 684.
Unwrought and semimanufactures	5,012	4,939	--	United Kingdom 3,556.
Manganese:				
Ore and concentrate	37,120	27,035	--	Ghana 26,650.
Oxides	187	NA	NA	NA.
Mercury 76-pound flasks	954	136	NA	NA.
Nickel:				
Matte, sinters, similar material	29	6	NA	NA.
Metal including alloys:				
Waste and scrap	2	1	NA	NA.
Unwrought and semimanufactures	697	403	--	West Germany 87; United Kingdom 52.
Platinum-group metals including alloys, unwrought and partly wrought troy ounces	46,458	17,201	--	United Kingdom 8,649.
Silver metal including alloys, unwrought and partly wrought do	672,175	433,134	100,149	United Kingdom 299,612.
Tin metal including alloys:				
Waste and scrap	1	23	--	NA.
Unwrought	50	25	--	NA.
Semimanufactures	58	164	--	United Kingdom 85.
Titanium oxides	3,644	NA	NA	NA.
Zinc:				
Ore and concentrate	--	10	NA	NA.
Oxides	929	NA	NA	NA.
Metal including alloys:				
Waste and scrap	147	334	NA	NA.
Unwrought	2,184	2,810	--	United Kingdom 2,010; Canada 699.
Semimanufactures	3,581	2,004	--	United Kingdom 1,411.
Other:				
Ores and concentrates	6,170	6,274	NA	NA.
Ash and residue containing nonferrous metals	449	555	NA	NA.
Waste and sweepings of precious metals kilograms	26	42	NA	NA.
Oxides, hydroxides, pentoxides	314	628	--	United Kingdom 544.
Metals:				
Metalloids	80	173	--	United Kingdom 91.
Alkali and alkaline earth	33	3	NA	NA.
Base metals including alloys, all forms	545	544	248	United Kingdom 184.
NONMETALS				
Abrasives, n.e.s.:				
Natural, crude	r1,186	447	NA	NA.
Artificial corundum	157	86	NA	NA.
Dust and powder of precious stones kilograms	59	1	NA	NA.
Grinding and polishing wheels and stones	629	782	28	United Kingdom 268; West Germany 198.
Asbestos, crude	8,014	7,564	--	Cyprus 3,698; Canada 2,200.
Barite and witherite	425	558	NA	NA.
Boron materials:				
Crude natural borates	1,762	1,642	NA	NA.
Oxide and acid	101	109	NA	NA.
Cement	314,082	409,114	--	Belgium-Luxembourg 123,708; United Kingdom 73,451; West Germany 62,720.
Chalk	8,197	6,139	--	United Kingdom 5,291.
Clays and clay products:				
Crude clays	36,854	35,008	--	United Kingdom 26,237; Spain 5,578.
Products:				
Refractory including nonclay brick	15,777	18,352	--	United Kingdom 14,216; Canada 1,594.
Nonrefractory	r43,987	56,569	--	United Kingdom 48,104.
Cryolite and chiolite	1	2	NA	NA.
Diamond, industrial carats	60,000	5,000	NA	NA.
Diatomite and other infusorial earth	946	1,217	NA	NA.
Feldspar and fluorspar	6,165	8,578	--	Norway 7,280.

See footnotes at end of table.

Table 3.—Ireland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude:				
Phosphatic	104,728	106,400	--	Morocco 74,225.
Potassic	10	--		
Other including mixed	r1,853	1,244	NA	NA.
Manufactured:				
Nitrogenous	137,204	421,056	7,195	Belgium-Luxembourg 123,414; Netherlands 122,542; West Germany 34,093.
Phosphatic	154,982	162,102	75,870	United Kingdom 30,193; Tunisia 21,955.
Potassic	334,022	377,126	--	West Germany 162,932; East Germany 93,431; France 64,190.
Other including mixed	326,272	432,919	69,943	United Kingdom 246,242.
Ammonia	107,565	30,827	--	Netherlands 20,551; United Kingdom 9,302.
Graphite, natural	88	66	NA	NA.
Gypsum and plaster	3,981	5,185	--	United Kingdom 3,744.
Lime	1,964	2,781	NA	NA.
Magnesium materials	22,479	29,776	--	Greece 10,034; United Kingdom 9,589; China, mainland 5,431.
Mica:				
Crude including splittings and waste	594	847	NA	NA.
Worked including agglomerated splittings	31	57	NA	NA.
Pigments, mineral including processed iron oxides	1,388	NA	NA	NA.
Pyrite, unroasted	--	1	NA	NA.
Salt	77,221	87,656	--	United Kingdom 63,370; West Germany 14,502.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	22,180	28,847	--	United Kingdom 27,369.
Caustic potash	583	861	NA	NA.
Soda ash	15,441	15,927	NA	United Kingdom 14,749.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	2,123	1,268	NA	NA.
Slate	549	555	NA	NA.
Other	6,333	3,049	NA	NA.
Worked:				
Slate	937	812	NA	NA.
Paving and flagstone	32	148	NA	NA.
Other	1,239	2,663	--	Italy 2,000.
Dolomite	944	1,689	NA	NA.
Gravel and crushed rock	282,429	409,501	--	United Kingdom 406,927.
Limestone excluding dimension	3,009	4,162	NA	NA.
Quartz and quartzite	465	301	NA	NA.
Sand excluding metal-bearing	126,676	177,665	--	United Kingdom 99,685; Belgium-Luxembourg 43,616.
Sulfur:				
Elemental:				
Colloidal	19	113	NA	NA.
Other than colloidal	8,592	534	NA	NA.
Sulfuric acid, oleum	34,678	83,832	--	United Kingdom 62,565; Netherlands 61,491.
Talc, steatite, soapstone, pyrophyllite	1,988	2,016	--	United Kingdom 1,462.
Other:				
Crude	6,233	8,058	--	United Kingdom 2,696.
Slag, dross, and similar waste, not metal-bearing	2,291	2,675	NA	NA.
Oxides and hydroxides, peroxides of strontium, magnesium, barium	23	68	NA	NA.
Fluorine, bromine, iodine	673	513	--	United Kingdom 232.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	14,027	24,791	--	United Kingdom 17,322; Belgium-Luxembourg 3,785.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3,004	3,479	NA	NA.
Carbon black	r6,494	7,762	--	United Kingdom 7,253; Netherlands 394.
Coal, anthracite and bituminous including briquets thousand tons	r 1838	1,216	220	Poland 706; United Kingdom 230.
Coke and semicoke	r10,411	9,457	--	United Kingdom 7,920.
Hydrogen, nitrogen, oxygen, rare gases	r3,360	5,747	--	United Kingdom 3,174.
Peat including briquets and litter	660	788	NA	NA.

See footnotes at end of table.

Table 3.—Ireland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	15,255	14,897	--	Saudi Arabia 7,926; Iraq 2,365; Iran 1,826.
Refinery products:				
Gasoline ---------- do	5,325	6,237	--	United Kingdom 5,823; Netherlands 202.
Kerosine ---------- do	r2,891	3,317	--	United Kingdom 3,242.
Distillate fuel oil ----- do	5,357	6,496	--	United Kingdom 5,363.
Residual fuel oil ------ do	11,558	12,597	--	United Kingdom 6,312; France 2,148; U.S.S.R. 832.
Lubricants ---------- do	411	436	--	United Kingdom 402.
Other:				
Liquefied petroleum gas do	r1,275	1,553	--	United Kingdom 1,463.
Mineral jelly and wax do	22	25	--	United Kingdom 18.
Bitumen and other residues do	748	690	--	Mainly from the United Kingdom.
Bituminous mixtures do	66	61	--	United Kingdom 60.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals -----	r5,803	6,947	--	United Kingdom 6,576.

rRevised. NA Not available.
[1]Including 33 tons of lignite.

COMMODITY REVIEW

METALS

Aluminum.—Another strike, this time resulting in a 7-week shutdown in May and June, delayed construction at the new alumina plant on Aughinish Island in the Shannon estuary. The strike by members of the Irish Transport and General Workers Union was over negotiations on previously agreed bonus payments; it was only 1 of about 12 disputes during the previous 12 months between the management, Alumina Contractors Ltd., representing the owners (Alcan, Billiton, and The Anaconda Company), and the 12 unions at the site. Cost estimates were consequently raised during the year to the $750 million[2] to $1 billion range, and the completion date was delayed to at least early in 1983. The plant was to process bauxite from Guinea and Brazil, largely for Alcan's European and North American aluminum smelters.

Copper.—Avoca Mines Ltd., operator of Ireland's only copper mine at Avoca, County Wicklow, granted Government assistance of £4.35 million to clear its debts and to reequip the mine.

Iron and Steel.—The modernization and expansion program of Irish Steel Ltd. (IS), formerly Irish Steel Holdings Ltd., was delayed considerably by failure of the manufacturer in England to deliver the new rolling mill on time. The plant, scheduled for commissioning in June, was now expected to be operational early in 1981.

In addition to the Ferrco-designed rolling mill, which was to produce sections up to 8 by 5-1/2 inches, new equipment included a three-strand Concast bloom caster, which started up in October, and a 90-ton Tagliaferri arc furnace, which began operating early in 1981.

IS suffered a loss of £6.4 million in the financial year to June 30, 1980, partly because of delays in commissioning the new plant and partly because of a somnolent market, according to IS's chairman. Output reached only 59,000 tons, with strong price competition from imports, compared with a nominal capacity of 150,000 tons per year, and a capacity of 300,000 tons per year after expansion is completed.

Lead-Zinc.—The Tynagh Mine, the original major lead-zinc producer in Ireland, which started up in 1965, was closed at the end of July. Modifications, however, were made in the surface plant for treating a stockpile of about 110,000 tons of ore, averaging about 7.5 ounces of silver per ton. Tynagh had been operated by Northgate Exporation and Development Ltd., of Toron-

to, Canada.

The application by Bula Ltd. for permission to mine its deposit near Navan, in County Meath, was rejected by the National Planning Appeals Board early in 1981, on the grounds that the opencast mine proposed was too close to residential properties and would pose polluton problems. An underground operation was being considered.

Tara Exploraton and Development Co. Ltd., at Navan, which attained almost full production by the beginning of the year, was just breaking even financially, because of a steep rise in operating costs, high interest rates, and a decline in metal prices. Profit for the year was only $108,000, compared with $9.05 million in 1979. Production of zinc in concentrates was 191,641 tons, and production of lead in concentrates was 30,000 tons. Capital investment, in view of the company's financial difficulties, was being limited to about $3 million per year, chiefly for the maintenance of long-term term production.

Plans to build a zinc smelter at Ballylongford, on the Shannon estuary, in western Ireland, were reportedly scrapped by the Irish Government in view of low zinc prices and rising construction costs.

NONMETALS

Barite.—The Glencarbury barite mine of Sligo Bay Barytes Ltd., a subsidiary of Imco Inc. (Halliburton) of the United States, at Ballintrillick (Ballaghnatrillick), County Sligo, ceased producton early in the year, apparently because of the low contract price of barite for North Sea drilling operations. The other major mines, Dresser Magcobar's Silvermines (about 270,000 tons per year), Milchem Inc.'s operations at the defunct Tynagh lead-zinc mine (60,000 tons per year), and the recently reopened Lady's Well Mine near Clonakilty, County Cork (50,000 tons per year), continued in operation.

Diamond.—The General Electric Co. (GE) of the United States announced that it had chosen Dublin as the locaton of a new industrial diamond plant, having been persuaded to change from its original choice, Livingston New Town in Scotland, by a direct grant of £17 million from the Irish Industrial Development Authority and by various tax concessions on its export profits. The factory, already under construction, was expected to create about 500 new jobs over the next 5 years.

The plant will be the second of its type in Ireland. The first, established by De Beers Ltd. of South Africa, in the early 1960's, is Ultra High Pressure Units (Ireland) Ltd., near the Shannon Airport. The new plant should increase GE's share of the estimated present world market of 100 million carats annually to almost equal that of De Beers.

Nitrogen.—The 366,000-ton-per-year (nitrogen content) ammonia plant near Cork, completed in 1979 for Nitrigin Eireann Teoranta (NET), the state-owned fertilizer company, ran into difficulties soon after commissioning. Profit on imports of ammonia was £5 million, but, overall, there was a loss of about £12 million, due to last-minute delays, a prolonged strike by employees early in 1980, and high financing costs.

MINERAL FUELS

Ireland supplied close to 20% of its total energy requirements from indigenous sources in 1980. The traditional and still important fuel was peat, which generated about one-quarter of the electricity used; hydropower also contributed to some extent, and there was a small production of coal. The construction of a nuclear powerplant at Carnsore Point, the extreme southeast point of Ireland, was still under discussion.

In January, a new Department of Energy was set up within the Irish Government, which assumed the responsibilities for formulation of an energy policy, formerly under the Department of Industry, Commerce, and Energy. A separate division dealing solely with energy conservation was set up within the department.

Coal.—The new Kealy Mine in the County Tipperary Coalfield (presumably in the Slieve Ardagh region) was expected to reach its planned output of 50,000 tons per year. A second mine in the Leinster (Castlecomer) Field nearby was opened. Coal in this area is anthracitic. In the Connaught semibituminous coalfield at Arigna, expansion was also under way on the local high-ash coals. It was estimated that a 25-year supply of coal is available there, and a 40-megawatt powerplant was being built to test fluidized bed combustion.

Natural Gas.—Production of the Kinsale Head Gasfield off the southern coast reached the planned rate of 125 million cubic feet per day during the year. Production from the field, which has reserves of over 1 trillion cubic feet, is sold to the state-owned Bord Gais Eireann, which in turn sells it the semi-state Electricity Supply

Board for electricity generation in the Cork area (69 million cubic feet per day), to NET for ammonia production near Cork (52 million cubic feet per day) and to the Cork Gas Co. for local use (4 million cubic feet per day).

The Irish Government was studying the feasibility of building a gasline to introduce Kinsale natural gas to the Dublin City gas system, which was currently supplied with expensive naphtha-based town gas. In addition to an 18-inch, 140-mile pipeline from Cork to Dublin, branches were being considered to other cities in Ireland, including Belfast in Northern Ireland. The pipeline was expected to cost £70 million to £100 million, and another £70 million would be required for improvements and extensions in the Dublin distribution system.

Peat.—The European Investment Bank, the long-term finance institution of the European Economic Commmunity, granted a loan of 4.5 million units of account (about £3 million or $6 million) to the Bord na Mona (Peat Board) to help develop the production of peat for fuel. The loan will go toward the sum needed (about 20 million pounds) to develop 7,000 acres of bogland in central Ireland, plus the construction of a factory at Littleton, County Tipperary, to convert the peat into briquettes at the rate of 130,000 tons of product annually by 1984.

Petroleum.—The Irish Energy Minister, reacting to press reports, said reserves in the British Petroleum (BP) discovery offshore in the Porcupine Basin, made in 1979, were not as high as rumored and most likely would be in the region of 100 million barrels. The site is in very deep water (1,200 to 1,400 feet) and rather rough seas, about 100 miles off the southwest coast.

BP confirmed in September the completion of a second successful well, 26/28-2, toward the complex western edge of the same structure as that tested in 1979 by its discovery well, 26/28-1. The second well, in 1,230 feet of water, flowed 39° to 41° API oil at rates of 1,120 and 370 barrels per day from two separate intervals. The earlier well had tested at rates of between 3,093 and 579 barrels per day. In addition to BP (38.5% of the equity), the group included Aran Energy (16.7%), Amerada Hess Corp. (20.0%), and Getty Oil International (Ireland) Ltd. (10.0%); the remainder of the equity was held by a group comprising Phillips Petroleum Co. (55%), Fina (35%), and Century Power and Light of Ireland (10%).

Phillips Petroleum was also continuing drilling in its area of the Porcupine Basin, where its original discovery was made, also in 1979, and the Elf Aquitaine group intended to test the western edge of the Porcupine Trough as well.

The Irish Government in November announced a second round of offshore petroleum licensing. For the previous 5 years, applications for exploration licenses had been accepted on an "open door" basis. The new policy was adopted to attract new companies and encourage greater competition, and hence more favorable terms for Ireland.

Under terms of the second round, bids were invited on 108 blocks in 5 areas. Forty-six are in the deeper part of the Porcupine Basin; 45 are in the Celtic Sea, south of Ireland, where the only producing field, the Kinsale Head Gasfield, is located; 6 are in the Donegal Basin northwest of Ireland; 4 are in the Kish Basin east of Dublin; and the remaining 7 blocks are in the Slyne Trough, a new area northeast of the Porcupine Basin and off the Mayo coast. Applications were to be accepted from November 16, 1981, to January 29, 1982. Awards were promised for early 1982.

The Government's fledgling Irish National Petroleum Corp., which was established in 1979, concluded two Government-to-Government contracts for the supply of petroleum from the Middle East. The first, with the Iraqi National Oil Co. late in 1979, was for 10,000 barrels per day; this subsequently became inactive because of the Iraq-Iran war. The second contract, for a similar amount from Saudi Arabia, started late in 1980. Each of these contracts would supply about 8% of Ireland's current consumption (122,000 barrels per day). Oil from both contracts was being refined in the United Kingdom because Ireland's one refinery could not handle additional supplies.

Uranium.—Munster Base Metals Ltd., a subsidiary of Anglo United Development Corp. Ltd. of Canada, continued to obtain good results in the exploration being carried out in the Fintown area of central Donegal. Drilling increased the known strike length to more than 520 meters, and additional drilling was to be undertaken on 2 targets to the east which showed strong induced polarization responses.

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[1]Physical scientist, Branch of Foreign Data.

[2]Average exchange rate at yearend was Irish pound (£) 1£=US$1.92.

The Mineral Industry of Israel

By Suzann C. Ambrosio[1]

Israel's mineral industry, consisting primarily of nonmetal chemicals, cement, fertilizer, and polished diamonds, continued to be highly export oriented. Israel Chemicals Ltd. (ICL), the Government holding company for all nonmetal mineral production, estimated the 1980 sales value of the potash, phosphate rock, bromine, and periclase at $225 million.[2] The overall economy grew at the projected rate of 4.2% with the total gross national product (GNP) estimated at $17 billion. Israel's chemical and fertilizer products, approximately 1.5% of the GNP, contributed 12% of total foreign export sales. Nearly 40% by weight of the world production of gem-quality diamonds were polished in Israel. The total value of diamond sales was approximately $1.6 billion. Diamond sales represent 10% of GNP and contributed 32% of export sales.

Despite the growth in some sectors of the economy, there was an increase in the number of unemployed and a continued spiral in inflation pressure causing a decline in domestic demand of products and a diminution overall in investments. The jobless rate during the first half of 1980 was 4.4% as compared with 2.8% in 1979. The unemployed tended to move into those developing areas where sophisticated technology and other production-oriented industries were expanding. Over 50% of those hired during the second half of 1980 were absorbed by these export industries.[3] Inflation was estimated at 133% in 1980 and continued to be driven up by the increases in oil import bills.

Economic policies implemented during 1980 included monetary and fiscal policy restraints and currency devaluation. The Israeli pound was renamed the shekel in February; 1 shekel equaled 10 Israeli pounds. The shekel was devalued in 1980 for a total reduction of 114% against the dollar and 106% against a basket of currencies belonging to Israel's major trading partners.[4] The Bank of Israel's policy attempted to keep devaluation equal to the differences between the domestic rate of inflation and inflation "imported" from abroad. Other Government financial policies focused on reducing the Government budget, revising the linkage system through a possible wage and price freeze, and promoting export industries.

There was a significant improvement in Israel's 1980 trade balance, primarily owing to increased export earnings and diminished growth of import expenditures (other than oil). Total exports grew 6% in real terms during 1980. The trend to support export industries through various credit incentives continued to increase. An import deposit scheme was in effect during 1980 that required a 10% import deposit where customs duties were required. The trade deficit declined 13% over that of the previous year to approximately $2.6 billion.

Exports of mineral, chemical, and metal industries exceeded the value from the food and textile industries for the first time. The change in export composition signifies the shift from light to heavy industries. The greatest growth in export revenues was attributed to the nearly 80% growth in nonmetallic products. Phosphate rock, potash, and polished diamond export revenues surpassed all other industrial products.

The country's transportation situation improved since the signing of the 1979 peace treaty with Egypt. The Suez Canal has been open to traffic from the Israeli Red Sea port of Eilat. Mine transport costs have declined owing to the elimination of lengthy trucking of products to Israel's Mediterranean ports. A new export depot at the cargo terminal at Ben-Gurion International Airport was inaugurated in September 1980.

Improvements in transportation and water facilities were planned for Samaria, other west bank development areas, and the eastern Negev. Construction on the east section of the Israel-Samaria road began in November in an effort to strengthen commerce between the settlements and the rest of the country. Work on the Negev water pipeline was renewed in 1980 after a 4-year work stoppage. The pipeline capacity was designed to reach 7,600 cubic meters per hour and was expected to facilitate increased water supplies to Beersheba.

Oil consumption remained stable at approximately 8 million tons during 1980. Israel is 98% dependent on oil for energy requirements and spends approximately 15% of GNP on petroleum imports. Steadily increasing oil expenditures and decreasing accessibility to markets have induced research and applications of alternative energy sources. The development of the Mediterranean-Dead Sea linkage in addition to coal, solar, and nuclear alternatives were among Israel's major national priorities. Near-term projects included the increased use of coal power and exploitation of Israeli-occupied oil and gasfields. Long-range projects, including hydroelectric, solar, and oil shale proposals, have been initiated through feasibility studies and pilot plants. A discovery of oil shale in the southern Negev nearly doubled known reserves to 4 billion tons.

PRODUCTION AND TRADE

Nonmetals continued to dominate Israel's mineral production. Expansion of the sector's production capacity and export potential was expected to continue to offset the high costs of importing required fuels and metals. Because Negev phosphate rock and Dead Sea potash and bromine production have grown to near capacity over the past 4 years, ICL targeted $65 million per year over the next 4 years for various expansion projects. ICL invested in transportation facilities and has subsequently focused on improving marketing infrastructure for chemical and fertilizer products.

The value of Israel's mineral exports showed marked increases in 1980. Mining, quarrying, and nonmetallic mineral products (excluding diamonds) increased 48.5% to approximately $156 million. Chemicals, rubber, and plastics grew 36.5% to approximately $757 million. Of total industrial exports (less diamonds), the shares of the two sectors, (1) mining, quarrying, and nonmetallic mineral products and (2) chemicals, rubber, and plastics, remained relatively stable at 5% and 27%, respectively.[5] Diamond export values increased to approximately $1.4 billion. Reported uncut and polished diamond imports grew by 11% (carats) and 43% (dollar value), and exports increased by 8% (carats) and 22% (dollar value).[6]

Although growth in the diamond export industry was reported during 1980, the published figures included large quantities of stones that were exported on consignment. It is doubtful whether many of these diamonds sold, since the world demand for diamonds has dramatically declined over the past 2 years. Israel's diamond industry was estimated to be set back by 10 years. By yearend 1980, nearly 40% of the workshops closed operations and approximately one-half of the 17,000 workers were let go. The major problem facing the industry was reducing supplies of rough diamonds for investments and polished diamonds that were hard to sell. The total debt of the industry to Israeli banks reached $1.2 billion in 1980.

Israel's balance of trade with the European Economic Community (EEC) was favorable in 1980. Exports to the EEC increased 45% overall; Italy's purchases increased 100% and France, Netherlands, and Federal Republic of Germany imports increased by 50%. The growth was indicative of the increase in both the volume of Israeli exports and the variety of exported products. Israel has maintained relatively small trade relationships with Eastern Europe and Africa. However, exports to Africa increased 66% in 1980. Less than 1% of South Africa's trade was shared by Israel, although Israel imports most of the uncut diamonds produced in the Republic of South Africa. Israel exported mostly fertilizers, chemicals, construction, materials and electrical equipment to Africa in return for metals, iron, steel products, and mineral fuels.

The balance of United States-Israeli trade remained fairly constant over the past 2 years. Israeli exports in 1979 were approximately $750 million and imports were $1.5 billion. Imports of capital equipment exceeded agricultural purchases for the first time. The emphasis on expanding Israeli export industries was reflected by a 45% increase in the purchase of machinery and equipment.

Table 1.—Israel: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Copper, cement (70%-80% Cu):[e]					
Gross weight	3,300	--	--	--	800
Metal content	2,500	--	--	--	600
Iron and steel:[e]					
Pig iron	(3)	(3)	(3)	(3)	--
Crude steel	r70,000	r72,000	r94,000	r107,000	107,000
NONMETALS					
Barite (60% $BaSO_4$)	--	--	--	500	500
Bromine:					
Elemental	20,900	31,500	34,550	45,813	50,000
Compounds	10,300	20,350	23,550	32,387	32,500
Cement, hydraulic thousand tons	1,999	1,964	1,996	1,920	[4]2,088
Clays:					
Flint clay	70,000	30,500	33,656	17,690	18,000
Metabentonite	15,000	8,000	6,952	6,287	6,000
Kaolin	10,000	5,500	6,350	22,317	20,000
Other	4,000	1,000	11,450	19,686	20,000
Gypsum	r65,000	r65,000	65,000	65,771	66,000
Lime	200,000	102,000	124,000	112,490	112,000
Nitrogen: N content of ammonia	e64,000	68,500	67,700	68,500	[4]54,800
Phosphate rock, beneficiated thousand tons	639	1,227	1,725	2,216	[4]2,610
Potash, K_2O equivalent do.	680	707	695	730	[4]797
Salt, marketed (mainly marine)	86,561	e100,000	121,560	107,352	110,000
Sand:					
Glass sand	84,000	83,500	86,864	71,033	78,000
Other (for building industry) thousand cubic meters	4,500	4,983	3,705	3,787	3,900
Sodium and potassium compounds: Caustic soda	24,009	26,836	21,626	26,400	34,286
Stone:					
Dimension, marble	16,000	22,000	e24,000	31,000	31,000
Crushed thousand cubic meters	13,000	NA	NA	12,103	12,000
Sulfur:					
Byproduct from petroleum	10,000	10,000	10,000	10,000	10,000
Sulfuric acid thousand tons	208	198	183	226	200
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, marketed million cubic feet	2,055	2,010	2,016	e2,000	1,200
Peat[e] thousand tons	20	20	20	18	20
Petroleum:					
Crude:					
From Israel proper thousand 42-gallon barrels	262	198	177	150	140
From occupied Sinai Peninsula do.	6	--	6,200	10,800	12,500
Refinery products:					
Gasoline do.	7,999	6,375	6,515	6,700	NA
Jet fuel do.	4,521	5,619	5,663	5,900	NA
Kerosine do.	1,893				
Distillate fuel oil do.	13,136	8,012	6,555	7,000	NA
Residual fuel oil do.	20,014	28,944	31,594	30,000	NA
Lubricants do.	262	NA	NA	NA	NA
Other do.	3,371	2,838	2,565	2,800	NA
Refinery fuel and losses do.	2,133	2,158	1,050	2,200	NA
Total do.	53,329	53,946	53,942	54,600	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 24, 1981.

[2]In addition to the commodities listed, Israel reportedly has the capacity to produce 71 tons of U_3O_8 per year, but official data are not reported and available information is inadequate to make reliable estimates of actual output levels.

[3]Revised to none.

[4]Reported figure.

Table 2.—Israel: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms[2]	r6,870	14,675	2,926	West Germany 2,817; Netherlands 2,368; Italy 1,021.
Copper:				
Copper cement value, thousands	r$22	$38	--	Singapore $29; West Germany $9.
Matte[3]	148	67	--	West Germany 29; Netherlands 19; Spain 19.
Metal including alloys:				
Scrap	2,223	[4]3,130	21	Belgium-Luxembourg 1,300; Netherlands 568; Switzerland 521; Spain 445.
Unwrought and semimanufactures[5]	r3,410	3,265	2,566	Netherlands 390; West Germany 214.
Gold metal including alloys, unworked or partly worked value, thousands	$233	$3,868	$6	West Germany $3,341; United Kingdom $460.
Iron and steel:				
Iron pyrites	--	5	--	Italy 3; West Germany 2.
Metal including alloys, all forms[6]	r8,519	21,757	838	West Germany 9,685; Greece 2,458; Belgium-Luxembourg 2,292; United Kingdom 2,177.
Lead metal including alloys, all forms	372	529	--	Belgium-Luxembourg 188; West Germany 89.
Magnesium metal including alloys, all forms value, thousands	$41	$27	--	West Germany $10; Italy $8; United Kingdom $6.
Nickel metal including alloys, all forms	48	63	6	United Kingdom 28; Netherlands 18.
Silver metal including alloys, unworked or partly worked value, thousands	$64	$733	--	All to West Germany.
Tin metal including alloys, all forms do	$12	$3	--	All to Cyprus.
Tungsten metal including alloys, all forms do	$1,021	$3,542	$2,052	Italy $840; United Kingdom $593; Switzerland $19.
Zinc metal including alloys, all forms[7]	1,293	3,067	--	Spain 2,639; Republic of South Africa 145.
Other:				
Ash and residue containing nonferrous metals	r476	8,264	7,826	Spain 227; Austria 108; Belgium-Luxembourg 100.
Base metals including alloys, all forms value, thousands	$229	$265	$263	Cyprus $2.
NONMETALS				
Abrasives, natural, n.e.s.: Grinding and polishing wheels and stones do	$524	$558	$285	Canada $119; France $39; Belgium-Luxembourg $25.
Barite and witherite	708	82	--	Republic of South Africa 72; Ethiopia 10.
Cement, white value, thousands	$6	--		
Clays and clay products (including all refractory brick):				
Crude clays, n.e.s.[8]	r12,363	5,384	--	All to Netherlands.
Products:				
Refractory (including nonclay bricks)	3,088	2,886	--	West Germany 1,608; Greece 506; Nigeria 161; Turkey 161.
Nonrefractory value, thousands	$501	$438	$18	Canada $341; Singapore $79.
Diamond, gem, not set or strung[9] thousand carats	r2,570	2,300	789	Hong Kong 323; Belgium-Luxembourg 299; Switzerland 224.

See footnotes at end of table.

Table 2.—Israel: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude:				
Phosphatic	r452,485	561,327	--	Italy 174,288; Norway 145,383; France 93,892.
Other[10]	5,764	15,298	--	West Germany 8,787; Belgium-Luxembourg 3,379.
Manufactured:				
Nitrogenous[11]	r2,468	691	--	Spain 109; Italy 108; Republic of South Africa 36.
Phosphatic[12]	r371,487	219,093	1	Netherlands 79,124; Belgium-Luxembourg 21,394; Nigeria 20,064.
Potassic value, thousands	$978	$1,822	--	Malawi $538; Greece $477; Africa $342.
Other including mixed[13]	r58,145	57,134	NA	France 17,128; Thailand 16,000; Africa 9,978.
Infusorial earth	--	[14]152		
Lime	336	71	--	All to Nigeria.
Magnesite	20,948	9,183	2,100	Austria 5,392; United Kingdom 1,250.
Precious and semiprecious stones, except diamond value, thousands	$21,640	$34,147	$12,726	Switzerland $8,314; West Germany $3,279.
Salt[15]	3,136	185	26	Asia 96; West Germany 59.
Sodium and potassium compounds, n.e.s.: Caustic soda	--	5	--	All to Turkey.
Stone and sand and gravel, all types[16]	r2,727	1,811	97	West Germany 1,029; Greece 635.
Sulfur:				
Elemental, all forms value, thousands	$10	--		
Sulfuric acid	269	9,351	--	Turkey 6,184; Switzerland 3,041.
Other nonmetals, n.e.s.:				
Crude value, thousands	--	$12	--	All to West Germany.
Oxides and hydroxides of magnesium and barium do	$2,506	$9,582	--	Austria $5,242; West Germany $3,066.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s.[17]	608	1,053	--	Nigeria 1,009; Cameroon 44.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	782	1,987	--	Kenya 775; Yugoslavia 675; Ethiopia 212.
Hydrogen, helium, rare gases value, thousands	$76	$109	--	United Kingdom $85; France $12.

rRevised. NA Not available.

[1]Data may be incomplete. Unless otherwise specified, the annual figures represent the sums of data for all countries for which a quantity figure is provided in official Israeli trade returns. Additional quantities may have been exported to other countries for which only a value figure is provided. In some cases, where it is clear that a significant portion was exported for which no quantity figure was provided, the value figure has been given in a footnote.

[2]Totals exclude quantities valued at $6,371,000 in 1978 and $8,490,000 in 1979.

[3]Totals exclude quantities valued at $3,000 in 1978 and $2,000 in 1979.

[4]Excludes quantity valued at $5,000.

[5]Totals exclude quantities valued at $195,000 in 1978 and $189,000 in 1979.

[6]Totals exclude quantities valued at $8,932,000 in 1978 and $5,373,000 in 1979.

[7]Totals exclude quantities valued at $77,000 in 1978 and $259,000 in 1979.

[8]Totals exclude quantities valued at $114,000 in 1978 and $266,000 in 1979.

[9]Totals exclude quantities valued at $166,921,000 in 1978 and $77,272,000 in 1979.

[10]Totals exclude quantities valued at $237,000 in 1978 and $13,000 in 1979.

[11]Totals exclude quantities valued at $2,010,000 in 1978 and $82,000 in 1979.

[12]Totals exclude quantities valued at $10,476,000 in 1978 and $24,946,000 in 1979.

[13]Totals exclude quantities valued at $50,132,000 in 1978 and $72,910,000 (of which $21,203,000 was to the United States) in 1979.

[14]Valued at $28,000, of which $15,000 was to Finland and $13,000 was to Italy.

[15]Totals exclude quantities valued at $4,000 in 1978 and $165,000 in 1979.

[16]Totals exclude quantities valued at $25,000 in 1978 and $127,000 in 1979.

[17]Totals exclude quantities valued at $291,000 in 1978 and $15,000 in 1979.

Table 3.—Israel: Imports of mineral commodities

Commodity	Quantity (metric tons unless otherwise specified)		Value, thousands			
			Of reported quantity		Of additional unreported quantity	
	1978[1]	1979	1978[1]	1979	1978[1]	1979
METALS						
Aluminum:						
Bauxite and concentrate	806	1,606	$229	$504	$102	--
Oxide and hydroxide	707	983	805	885	64	$32
Metal including alloys, all forms	52,835	34,067	63,567	68,526	1,952	571
Cadmium metal including alloys, all forms	2	NA	12	NA	46	208
Chromium oxide, hydroxide, trioxide	NA	14	NA	262	187	11
Copper metal including alloys, all forms	16,986	28,047	38,149	46,536	1,542	1,441
Gold metal, unworked or partly worked troy ounces	1,672	58,061	3,681	82,589	52,648	3,401
Iron and steel metal:						
Scrap	11,741	20,501	1,154	4,755	--	22
Pig iron, ferroalloys, similar materials	1,855	15,656	1,685	5,324	549	570
Steel, primary forms	64,262	64,396	16,475	22,526	1,787	528
Semimanufactures:						
Bars, rods, angles, shapes, sections	3,803	5,130	14,679	18,321	585	189
Universals, plates, sheets	2,234	2,795	10,399	11,171	1,424	1,972
Hoop and strip	3,274	3,473	8,103	10,489	1,181	544
Rails and accessories	47	30	253	1,141	374	1,441
Wire	8,108	13,160	10,778	16,160	1,172	319
Tubes, pipes, fittings	4,703	6,725	14,615	22,503	4,814	5,089
Lead:						
Oxides	649	362	860	773	25	--
Metal including alloys, all forms	2,945	2,939	2,401	3,676	60	119
Magnesium metal including alloys, all forms	27	170	159	1,630	1,225	76
Manganese oxides	NA	NA	NA	NA	310	381
Mercury 76-pound flasks	87	290	28	140	10	29
Molybdenum metal including alloys, all forms	NA	NA	NA	NA	261	131
Nickel metal including alloys, all forms	100	144	1,642	3,138	869	605
Platinum-group metals including alloys, all forms troy ounces	NA	6,173	NA	1,332	745	--
Silver metal including alloys, all forms do	1,818,090	537,463	4,472	8,202	1,307	239
Tin metal including alloys, all forms	19	35	1,239	2,002	304	425
Titanium oxides	127	1,690	1,955	4,818	1,076	248
Tungsten metal including alloys, all forms	67	777	3,294	15,322	13,154	55
Zinc:						
Oxide	46	280	751	1,062	31	12
Metal including alloys, all forms	8,138	6,642	4,817	6,164	190	495
Other:						
Ores and concentrates, n.e.s	57	245	183	489	113	148
Oxides, hydroxides, peroxides of metals, n.e.s	NA	61	NA	1,008	970	120
Metals including alloys, all forms, n.e.s	9	69	66	3,482	2,218	647
NONMETALS						
Abrasives, natural, n.e.s.:						
Pumice, emery, natural corundum, etc	39	76	65	145	107	25
Corundum, artificial	140	120	242	217	23	--
Dust and powder of precious and semiprecious stones	NA	NA	NA	NA	6	31
Grinding and polishing wheels and stones	NA	NA	NA	NA	1,574	1,920
Asbestos	4,879	28,317	5,392	8,763	61	--
Barite and witherite	NA	NA	NA	NA	135	6
Boron materials, oxide and acid	31	36	127	60	40	40
Cement	114,795	261,457	10,756	25,124	353	--
Chalk	779	205	234	402	14	23
Clays and clay products (including all refractory brick):						
Crude clays: Andalusite, kyanite, etc	9,587	22,640	2,622	3,202	4	98
Products:						
Refractory (including nonclay bricks)	1,008	1,630	1,744	2,964	400	446
Nonrefractory	NA	NA	NA	NA	8,317	11,851

See footnotes at end of table.

Table 3.—Israel: Imports of mineral commodities —Continued

Commodity	Quantity (metric tons unless otherwise specified)		Value, thousands			
			Of reported quantity		Of additional unreported quantity	
	1978[1]	1979	1978[1]	1979	1978[1]	1979
NONMETALS —Continued						
Diamond:						
Gem, not set or strung thousand carats	8,691	5,712	1,322,839	1,011,394	330	319
Industrial do	3,046	2,068	13,472	8,429	--	--
Diatomite and other infusorial earth	89	191	437	344	66	15
Feldspar and fluorspar	227	365	60	166	119	--
Fertilizer materials, manufactured:						
Nitrogenous	60	660	73	954	999	1,391
Other including mixed	4	5	10	15	809	121
Graphite, natural	17	3	16	77	68	33
Gypsum and plasters	186	131	120	99	--	65
Magnesite	1,458	2,097	574	565	28	58
Mica	24	102	69	96	55	13
Pigments, mineral including processed iron oxide	155	555	564	762	77	--
Precious and semiprecious stones except diamond:						
Natural	NA	NA	NA	NA	19,798	27,241
Manufactured including synthetic	NA	NA	NA	NA	146	202
Salt	2,775	9,212	729	901	67	54
Sodium and potassium compounds, n.e.s	177	10,708	147	1,539	353	446
Stone and sand and gravel:						
Dimension stone:						
Crude and partly worked	1,595	1,223	1,315	953	337	717
Worked	NA	NA	NA	NA	3,500	3,554
Dolomite, chiefly refractory grade	18	--	10	--	--	--
Gravel and crushed rock	29,001	42,466	1,783	2,576	--	--
Quartz and quartzite	104	97	53	64	--	--
Sand, excluding metal-bearing	38	52	59	61	11	58
Sulfur:						
Elemental, all forms	25,890	50,693	2,789	7,515	1,174	1
Sulfuric acid	6,167	152	1,244	115	137	--
Talc, steatite, soapstone, pyrophyllite	120	655	167	433	157	--
Other nonmetals, n.e.s.:						
Crude	17	10	102	56	226	288
Oxides and hydroxides of magnesium, strontium, barium	9	11	82	102	58	17
Bromine, iodine, fluorine	NA	NA	NA	NA	41	51
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	22	1,516	49	1,094	261	630
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	126	467	896	2,506	113	--
Coal, all grades, including briquets	305	244	167	142	140	99
Coke and semicoke	12	1,129	55	503	208	--
Gas, hydrocarbon, natural	2,311	1,939	575	473	1	--
Peat including peat briquets and litter	154	208	50	432	406	56
Hydrogen and rare gases	5	2,200	123	389	769	746
Petroleum:[e]						
Crude and partly refined thousand 42-gallon barrels	59,058	NA	NA	NA	--	--
Refinery products, unspecified do	23	NA	NA	NA	--	--
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	589	149	249	235	36	304

[e]Estimated. NA Not available.

[1]Many entries have been revised from those shown in the previous edition of this chapter on the basis of revisions published in official Israeli trade returns for 1979.

COMMODITY REVIEW

METALS

Copper.—Timna copper mines, just north of Eilat in the Negev Desert, had approximately 21 million tons of proven copper ore reserves. Owing to depressed world copper prices, the mines were closed from March 1976 until October 1980. The decision to reopen the mines was based in part on increased world copper demands, rising prices, and new extraction technologies. Timna researchers have proposed an extraction method that will produce various copper and manganese chemicals from the ore. Cement copper in the form of precipitates will still be produced but at lower output levels. Peak production of cement copper was 10,000 tons in 1975, and renewed levels were expected to reach 4,000 tons.

Magnesium Compounds.—Dead Sea Periclase Ltd. (DSP), jointly owned by Israel Chemicals (71.5%) and General Refractors (U.S.-owned Austrian company), produced periclase, a form of refractory magnesia. Residual Dead Sea brines were processed for the production of 99.4% pure magnesium oxide and hydrochloric acid. All of the manufactured periclase was exported to Europe. The hydrochloric acid was sold to Negev Phosphates and used in the production of phosphoric acid. Magnesium compounds production in 1979-80 was near full capacity of 50,000 tons. Recent increases in periclase prices and wider market applications encouraged DSP to expand production. DSP reported plans to increase production by 15% over the next 5 years.

NONMETALS

Bromine.—The Dead Sea Bromine (DSB) group, a subsidiary of Dead Sea Works (DSW), was composed of Dead Sea Bromine Co. Ltd. (DBC), Bromine Compounds Ltd. (BCL), Eurobrom B.V., and Broomchemie B.V., Netherlands. The company estimated reserves of 1 billion tons of recoverable Dead Sea bromide salts. Elemental bromine was extracted from Dead Sea brines at DSW's Sedom plant. Roughly one-third of the bromine was sent for processing in the Netherlands, and two-thirds was locally processed at the Beersheba and Ramat Hovev plants.

DSB was the world's largest single exporter of bromine compounds and was second only to the United States in production. DSB's extraction plant was projected to increase current capacity of 40,000 tons per year to 70,000 tons per year.

Cement.—Nesher Cement Co., Israel's only cement producer, owned five quarries and three plants in Haifa, Ramle, and Har Tuv. The plants produced portland cement (roughly equivalent to American Portland Type 1) from 95% clinker and 5% gypsum. Approximately 10% of the clinker was imported from various Mediterranean countries to meet domestic demand. To meet the projected 14% increase in 1981 cement consumption (2.5 million tons), Nesher has invested in a new quarry at Tamra and a grinding mill at Har Tuv. The plant was scheduled for completion in January 1981 and will raise Nesher's grinding capacity to 2.5 million tons annually. A fourth plant, to be located at Tel Yeshua pending environmental approval, would add approximately 500,000 tons of clinker output per year.

Fertilizer Materials.—*Phosphorous.*—Negev Phosphates Ltd. (NPL) estimated that 350 million tons of minable phosphate rock existed in the Negev Desert. NPL produced varying qualities of 20% to 30% P_2O_5 at four processing plants. These were located at Oron (calcinated rock and defluorinated phosphate ore), Arad (phosphoric acid and rock phosphate), Makhtesh (rock for superphosphate), and Zin (washed phosphate). During 1980, the plants averaged 80% of their production capacities.

Oron Mine, the oldest phosphate mine in Israel, utilized an energy- intensive calcination process to produce 73% to 75% BPL (bone, phosphate, and lime) grade phosphate rock. Plant capacity in 1980 was 500,000 metric tons per year. Owing to increased fuel costs, alternative production of semicalcined phosphate was undergoing trial production. Transportation difficulties at the Makhtesh Mine were expected to cause operations to cease within 5 years. The newest operation, Zin Mine, produced low chloride 70% to 72% BPL washed rock with a plant capacity of 2 million tons per year. The Zin plants located in the Hor Hahar Field were operating at 85% capacity in 1979-80. Slight modifications may potentially increase the plants' capacity to 3 million tons per year.

Completion of the Mishor Rotem fertilizer plant by Rotem Fertilizers Ltd. was scheduled for 1981. An improvement in Arad's

high-grade phosphate rock sales was expected. The opencast mining expansion of the low-grade upper beds for Rotem's fertilizer feedstock should ultimately allow greater mining of the high-grade lower phosphate beds.

Construction of Rotem Fertilizers Ltd. phosphoric and sulfuric acid plants in Arad were proceeding on schedule. Monsanto Industrial Chemicals Co. designed the sulfuric acid plant, and a French company was building the phosphoric acid plant. Both plants were expected to be completed by the second half of 1981. All aspects of phosphate rock supply from rock mining through processing and delivery were controlled by NPL. The value of phosphate rock exports in 1979-80 increased by approximately 40% over 1978-79 levels, while production of phosphate rock increased only 18%. Output of phosphate rock in 1981 was expected to increase another 50% over 1980 production levels. Exports of phosphoric acid were projected to increase sixfold to 150,000 tons per year in 1981.

Potassium.—DSW produced five grades of muriate of potash and the coproducts magnesium chloride, industrial salt, and table salt. Almost all of DSW's potash was exported directly as potassium chloride and indirectly as potassium nitrate and potassium sulfate. Although potash production slightly increased between 1975-80, current sales have doubled 1975-76 levels. World demand was expected to increase 5% per year, and DSW planned to increase potash production capacity by 15% per year between 1980-85. Israel was the fifth largest producer and contributed 3% of the global potash requirements during 1980. The expansion plans were expected to add 900,000 tons in a two-phase construction project. DSW's 2.1-million-ton production capacity expected in 1985 represents 7% of the world's projected demand.

Trans Pacific Resource Inc., a subsidiary of Estech General Chemicals Ltd. of Chicago, acquired 20% of Haifa Chemicals Ltd. The Israeli company was the world's single largest producer of potassium nitrate fertilizer and manufactures a variety of phosphate-based chemicals. Haifa Chemicals 1979 annual report showed a 30% increase in exports over those of the previous year. Estech's large marketing potential and the two firm's complementary products would allow further expansions in Haifa Chemical's export markets.

MINERAL FUELS

Energy.—The expansion of natural gas output from the Sinai fields were expected to continue. New wells in the gasfield near Sadot Moshav were projected to boost production by 40% to about 40 million cubic feet per day. The fields will be returned to Egypt in 1981 as part of the Israeli-Egyptian peace treaty. A gradual Israeli defense force withdrawal from the eastern section was scheduled through April 1982.

The Israeli Government put into motion the first of a series of feasibility studies for the Mediterranean-Dead Sea canal and tunnel linkage. The project was intended to replenish the water level of the Dead Sea and power a 600-megawatt hydroelectric plant. A 1-year feasibility study during 1981 was to involve drilling, mapping, and seismic testing.

The 150-kilowatt pilot solar-electric power station at Ein Bokek on the west bank of the Dead Sea has demonstrated Israel's solar potential. The continuous generating system based on the Ormat Organic Rankine Cycle and a solar pond utilized water, salt, and solar energy. Another 5,000-kilowatt solar power station was expected to be operational by 1981. The plants were part of a 2,000-megawatt Dead Sea solar complex.

Coal.—The Israel Electric Corp. (IEC) was in the process of shifting the supply source of Israel's electricity generation from oil to imported coal. Construction of the Hadera coal complex with four 350-megawatt generating units continued in 1980. Design features have been built into the complex to accommodate alternative firing by bunker "C" fuel oil or crude oil. Construction of the first two generating units neared completion by yearend 1980. The rescheduled start-up date for the first unit was 1981, and the second unit was expected to come online in 1982.

IEC had contracted Trinacria Lavoria Maritimi (Italy) to build the world's largest offshore unloading terminal near Ashdod. The first section of the 2,000-meter trestle and pier was scheduled for completion by March 1981. When finished there will be two stationary 225-ton-capacity cranes and two 150-centimeter-wide conveyor belts to carry the coal. The present mooring space can accommodate ships carrying up to 130,000 tons of coal. This may be extended for the next generation of ships with capaci-

ties up to 170,000 tons. Total unloading capacity may reach 9 million tons per year.

Coal supply agreements have been signed between the IEC and the Republic of South Africa, the United States, and Australia. Nearly half of the Hadera plant's coal requirements were expected to be imported from South Africa during the next 6 years. The United States was expected to supply 1 million tons of coal for 30 consecutive years. The remaining coal supplies were expected to be imported from Australia. Long-range electric generation plans included another coal-powered plant in Ziqim to be constructed in 1987.

Petroleum.—Small quantities of crude oil continued to be produced in the Heletz Fields near Ashquelon. Extensive oil exploration carried out during 1980 in Sedom and the Dead Sea area was expected to continue in 1981. Two studies estimated oil reserves of 500 million and 2 billion barrels for Israel. Hanah, the Government oil investment company, planned to conduct seismic surveys of all potential oil- and gas-bearing sites. The Ministry of Energy and Infrastructure reported that there were no restrictions whatsoever for U.S. citizens to own or control any interest in companies seeking oil and gas exploration rights in Israel.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Israeli pounds (I£) to U.S. dollars at the rate of I£25.43=US$1.00.

[3]Ha'Aretz (Tel Aviv). Dec. 3, 1980, p. 5.

[4]Jerusalem Post. Jan. 1, 1981, p. 1.

[5]The Israel Economist (Jerusalem). V. 27 , January 1981, p. 7.

[6]Ha'Aretz (Tel Aviv). July 21, 1980, p. 11. Reported figures represent the fiscal year from June 1979 through July 1980.

The Mineral Industry of Italy

By Roman V. Sondermayer[1]

As in the past, Italy was a significant processor of imported raw minerals and crude petroleum during 1980. In addition to construction materials, major minerals mined in the country included ornamental stone, pumice, feldspar, pyrite, fluorspar, barite, asbestos, and zinc. The mining and minerals processing industry of Italy contributed an estimated 11% in the country's gross national product.

The indexes for the mineral industry's activities for the latest 5 years are shown in the following tabulation:

	1976	1977	1978	1979	1980
All industry	122	123	126	134	142
Extractive industry	98	94	94	101	97
Mining of metals	66	49	45	39	39
Mining of nonmetals	102	99	100	107	104

Employment in the mineral industry has declined during recent years. The following tabulation shows the latest data on such employment:

	1976	1977	1978	1979	1980
Mining of metals	6,705	5,198	4,285	3,725	NA
Mining of nonmetals	9,268	8,061	7,104	7,001	NA
Total	15,973	13,259	11,389	10,726	9,671

NA Not available.

The declining state of the mineral industry was caused by various factors; most frequently mentioned were lack of a firm mineral policy; scarcity of capital, because mining was considered too risky a venture; a sharp decline in grades of ores mined in certain mines; and exhaustion of some deposits.

In January 1980, the Council of Ministers approved and submitted to Parliament a draft law regulating all activities of the mineral industry. The proposed law made provisions to assure supply of raw materials; improve recovery of minerals in mines, beneficiation plants, and smelters; and stimulate conservation and regulate operations of marginal ventures, which are kept active for social reasons. Reports indicated Parliament may enact the law during 1981 but its final form was difficult to foresee. The three major political parties in Italy have diverging views on the new mining law and major changes are possible.

The major events in the mineral industry of Italy during 1980 included reorganization of the state-owned steel group Finsider; startup of a new steel plant near Brescia; closure of the Salafossa lead-zinc mine in the Province of Belluno; temporary closure of the potash mine at Racalmuto, Sicily; continuation of work for reopening the Sulcis coal mines in Sardinia; discovery of a gasfield near Ravenna; and placement under extraordinary administration of the largest Italian independent petroleum group owned by Attilio Monti.

PRODUCTION

During 1980, the mineral industry of Italy, including processing and mineral fuels, showed mixed results. Extractive industry, mostly metals, declined. Table 1 shows production trends for the latest 5 years.

The mining and processing sectors were owned by public and private companies. The Government, with Ente Nazionale Idrocarburi (ENI) and its affiliates Societa per Azioni Minero-Metallurgiche (SAMIM) and Azienda Generali Italiana Petroli S.p.A. (AGIP); Finsider, with its subsidiary Italsider; and the Government-owned potash mines, controlled most of the sector. Societa Mineraria e Metalurgica di Pertusola S.A. (Pertusola) in lead-zinc, Acciaierie Ferriere Lombarde Falck (Falck) in steel, and major foreign oil and gas companies were the principal privately owned companies of the sector.

Table 1.—Italy: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Bauxite	24,200	34,525	24,410	26,095	23,260
Alumina	r797,803	r788,300	818,538	854,120	900,373
Metal:					
Primary	206,465	r260,086	270,770	269,112	291,199
Secondary	198,000	225,000	222,000	245,000	244,400
Antimony:					
Mine output, metal content	1,009	808	931	950	713
Regulus	r1,263	r673	14	--	--
Metal	765	875	794	776	676
Bismuth metal	56	8	9	19	43
Cadmium metal, smelter	r435	r448	378	527	568
Copper:					
Mine output, metal content	916	700	489	489	604
Metal, refined, secondary	26,800	20,000	17,500	15,600	12,200
Iron and steel:					
Iron ore and concentrate:[2]					
Gross weight thousand tons	514	478	353	219	185
Iron content do	257	201	139	88	73
Metal:					
Pig iron do	11,631	11,411	11,340	11,327	12,149
Ferroalloys:					
Blast furnace:					
Spiegeleisen	2,635	5,930	2,592	3,019	4,990
Ferromanganese	62,699	57,679	61,822	67,384	e61,000
Electric furnace:					
Ferromanganese	15,760	17,481	28,107	21,886	e22,092
Silicomanganese	41,386	40,050	42,615	54,513	44,914
Ferrosilicon	78,934	76,511	67,700	80,521	71,857
Silicon metal	17,700	16,300	14,422	e15,000	e15,000
Ferrochromium	45,264	39,753	36,877	42,531	41,150
Ferrochromium-silicon	(3)	--	230	(3)	--
Other	5,794	8,768	7,561	11,108	14,679
Total	270,172	262,472	261,926	295,962	275,682
Crude steel thousand tons	r23,447	23,334	24,283	24,250	26,501
Semimanufactures:					
Wire rod do	1,309	1,483	1,775	1,758	1,933
Sections do	7,186	7,591	7,965	8,331	8,782
Plates and sheets do	5,559	5,591	5,545	5,457	NA
Hoop and strip do	843	824	822	872	871
Railway track material do	235	199	197	221	NA
Ingots, semimanufactures and solids for tubes do	1,060	1,012	1,089	1,058	NA
Other do	781	708	602	851	NA
Total do	16,973	17,408	17,995	18,548	NA
Castings and forgings do	570	669	631	672	747
Cold-rolled sheet do	2,893	2,829	2,785	2,851	NA
Seamless tubes do	806	772	836	824	NA

See footnotes at end of table.

Table 1.—Italy: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Lead:					
Mine output, metal content	29,395	31,500	30,500	28,057	22,879
Metal:					
Refined:					
Primary	46,013	34,215	31,110	26,840	42,057
Secondary	72,187	83,500	85,100	101,000	91,600
Magnesium metal, primary	r8,836	r8,766	9,678	8,757	7,886
Manganese, mine output:					
Gross weight	4,461	9,314	9,741	9,782	9,165
Metal content	1,338	2,798	2,143	2,935	2,763
Mercury metal 76-pound flasks	22,278	406	87	--	96
Silver metal thousand troy ounces	1,593	1,222	890	1,065	1,366
Tin alloys	6,100	5,900	6,100	5,600	e5,500
Zinc:					
Mine output, metal content	86,400	79,300	73,329	66,285	58,417
Metal, primary	191,221	169,391	177,552	202,272	206,430
NONMETALS					
Asbestos	164,788	149,327	135,402	143,931	157,794
Barite	179,107	r152,646	236,613	214,630	203,038
Bromine	558	626	e590	e590	e590
Cement, hydraulic thousand tons	r36,287	r38,204	38,232	39,289	41,772
Clays, crude:					
Bentonite do	235	280	235	282	323
Refractory (excluding kaolinitic earth) do	234	259	363	268	226
For cement do	r5,183	NA	NA	NA	NA
For brick and terra cotta do	31,079	NA	NA	NA	NA
Fuller's earth do	24,859	6,344	3,975	1,080	4,300
Kaolin thousand tons	r82	r82	70	67	67
Kaolinitic earth do	27	r21	3	25	27
Diatomite	18,220	e30,000	e30,000	e30,000	e30,000
Feldspar	182,605	213,593	250,972	294,648	344,301
Fluorspar:					
Acid-grade	175,261	143,335	130,018	134,349	124,774
Metallurgical-grade	27,200	29,220	27,500	41,557	26,229
Ceramic-grade	8,351	13,194	13,580	6,885	962
Total	210,812	185,749	171,098	182,791	151,965
Graphite, all grades	3,848	3,819	4,108	4,102	3,957
Gypsum except dimension stone use thousand tons	r3,877	4,180	e4,200	e4,200	e4,200
Lime, hydrated and quicklime do	2,188	2,197	2,141	2,100	e2,100
Nitrogen: N content of ammonia do	1,219	1,168	1,444	1,430	1,397
Perlite[e] do	95,000	90,000	90,000	90,000	90,000
Pigments, mineral: Iron oxides, natural	1,800	e1,700	e1,400	e1,000	1,000
Potash, crude salts:					
Gross weight thousand tons	1,696	1,879	1,636	1,527	1,302
K_2O equivalent do	r203	e225	196	182	156
Pumice and related materials:					
Pumice and pumiceous lapilli do	862	e750	e780	e850	e900
Pozzolan do	5,080	e5,700	e5,800	e5,900	e6,000
Pyrite, all types, gross weight do	850	863	786	804	859
Salt:					
Marine, crude do	603	r1,019	1,210	e1,200	e1,300
Rock and brine do	3,410	3,600	3,721	4,490	3,997
Sand and gravel:					
Silica sand do	4,261	NA	NA	NA	NA
Volcanic sand do	181	NA	NA	NA	NA
Other sand and gravel do	124,736	NA	NA	NA	NA
Sodium and potassium compounds:					
Caustic soda	11,391	11,150	9,871	9,858	10,050
Sodium carbonate[e] thousand tons	94	95	95	95	95
Sodium sulfate do	r941	r1,018	1,012	e1,010	1,000
Stone:					
Dimension stone:[4]					
Calcareous:					
Alabaster and onyx do	r16	NA	NA	NA	NA
Limestone do	r851	r e850	r e850	NA	NA
Marble in blocks:					
White do	1,170	e1,100	e1,100	NA	NA
Colored do	r822	e800	e800	NA	NA
Schist (calcareous) do	r35	r e35	r e35	NA	NA
Travertine do	1,008	e1,330	e1,330	1,302	NA
Tufa do	3,530	r e3,500	r e3,500	NA	NA

See footnotes at end of table.

Table 1.—Italy: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Stone —Continued					
Dimension stone[4] —Continued					
Other:					
Breccia and puddingstone thousand tons	28	NA	NA	NA	NA
Diorite do	5	NA	NA	NA	NA
Gneiss do	r362	r448	448	NA	NA
Granite do	r122	740	740	NA	NA
Lava, basalt, trachyte do	r116	5,660	5,660	NA	NA
Porphyry do	r352	r e350	r e350	NA	NA
Quartz and quartzite do	40	NA	NA	NA	NA
Sandstone do	r463	r e470	r e470	NA	NA
Slate do	98	100	100	NA	NA
Syenite do	7	NA	NA	NA	NA
Tuff, volcanic do	r2,418	r e2,400	r e2,400	NA	NA
Crushed and broken:					
Calcareous:					
Dolomite do	1,048	1,000	1,000	NA	NA
Limestone:					
For cement and lime do	37,412	e39,000	e39,000	e40,000	NA
For construction do	11,462	e11,500	e12,000	e12,500	NA
Marble:					
White do	564	NA	NA	NA	NA
Colored do	1,100	NA	NA	NA	NA
Marl for lime do	423	e430	e420	e430	NA
Travertine do	261	NA	NA	NA	NA
Tufa do	3,843	NA	NA	NA	NA
Other:					
Gneiss do	99	NA	NA	NA	NA
Granite do	180	NA	NA	NA	NA
Lava, basalt, trachyte do	972	NA	NA	NA	NA
Porphyry do	5	NA	NA	NA	NA
Quartz and quartzite do	455	e480	e480	NA	NA
Sandstone do	415	NA	NA	NA	NA
Serpentine[4] do	525	r e525	r e525	NA	NA
Tuff, volcanic do	2,869	3,000	3,000	NA	NA
Strontium minerals	e700	e700	365	1,693	1,053
Sulfur:					
Gross weight of ore thousand tons	r349	r628	523	108	101
Recovered as elemental and in compounds:					
Elemental from ore do	35	36	104	19	23
S content of pyrite do	366	371	330	302	331
Byproduct, oil refining do	e35	e36	e36	e37	30
Byproduct, other sources[e] do	176	223	214	213	220
Total do	612	666	684	571	604
Talc and related materials	153,836	r165,356	167,740	157,382	165,905
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bituminous rock, natural:					
For distillation	54,299	64,924	46,638	124,731	117,893
For paving	76,177	77,419	68,560		
Carbon black	144,045	158,630	155,763	e170,000	e170,000
Coal:					
Subbituminous (sulcis coal) thousand tons	1	(5)	--	--	--
Lignite do	2,028	r1,844	1,868	2,123	1,933
Coke, metallurgical do	7,970	7,676	7,317	7,502	e7,600
Gas, natural, marketed million cubic feet	552,336	485,115	484,932	475,553	442,543
Natural gas liquids: Natural gasoline thousand 42-gallon barrels	120	281	NA	NA	NA
Petroleum:					
Crude do	7,553	r7,378	9,893	11,360	12,264
Refinery products:					
Gasoline:					
Aviation do	376	416	303	578	1,709
Motor do	122,363	135,462	138,975	141,398	124,550
Jet fuel do	12,920	12,988	15,680	16,520	14,720
Kerosine do	26,760	23,104	23,436	24,784	18,747
Distillate fuel oil do	200,527	198,706	222,584	225,889	190,603
Residual fuel oil do	289,148	305,342	318,448	333,300	244,935

See footnotes at end of table.

Table 1.—Italy: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Lubricants thousand 42-gallon barrels	4,795	5,586	5,985	6,440	7,196
Other do	128,953	125,396	85,632	86,788	76,105
Refinery fuel and losses do	47,145	49,180	54,263	49,696	42,231
Total do	832,987	856,180	865,306	885,393	720,796

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Sept. 28, 1981.
[2]Excludes pelletized iron oxide derived from pyrite.
[3]Included with other if any was produced.
[4]Serpentine output for dimension stone applications (if any) is included with crushed and broken stone.
[5]Less than 1/2 unit.

TRADE

The supply position of Italy did not change during 1980, and Italy remained dependent on imports of large quantities of raw materials and fuels. Tables 2 and 3 show details of Italy's foreign trade in minerals.

Table 2.—Italy: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	12,240	27,565	--	Greece 6,710; France 6,236; West Germany 4,863.
Oxide and hydroxide	327,599	417,897	--	Netherlands 144,317; Norway 114,085; United Kingdom 48,760.
Ash and residue containing aluminum	6,609	6,685	--	France 3,326; West Germany 3,122.
Metal including alloys:				
Scrap	1,023	1,255	--	West Germany 758; France 428.
Unwrought	69,933	22,758	1,244	West Germany 10,217; China, mainland 4,161.
Semimanufactures	108,802	112,691	6,263	West Germany 22,365; France 21,847; United Kingdom 8,677.
Antimony:				
Ore and concentrate	36	3	NA	NA.
Metal including alloys, all forms	61	20	NA	NA.
Arsenic trioxide, pentoxide, acid	[r]25	20	NA	NA.
Bismuth metal including alloys, all forms	30	6	NA	NA.
Cadmium metal including alloys, all forms	124	259	--	West Germany 46; Hungary 32; United Kingdom 20.
Chromium:				
Chromite and concentrate	3,606	2,673	--	Australia 1,217; Yugoslavia 916.
Oxide and hydroxide	1,835	1,444	--	France 1,072; Turkey 99.
Metal including alloys, all forms	39	14	NA	NA.
Cobalt:				
Oxide and hydroxide	10	5	--	All to West Germany.
Metal including alloys, all forms	97	108	--	West Germany 67; Switzerland 17.
Columbium and tantalum metals, all forms	17	5	NA	NA.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Copper:				
Ore and concentrate	2,595	1,232	--	Spain 1,170.
Ash and residue containing copper	13,525	17,282	--	West Germany 10,942; Sweden 3,250; Austria 1,957.
Sulfate	2,597	3,005	--	France 865; Ireland 380; West Germany 375.
Cement copper	45	328	--	Spain 320.
Metal including alloys:				
Scrap	9,088	15,722	--	West Germany 9,593; Belgium-Luxembourg 2,722; Austria 1,617.
Unwrought:				
Blister	877	72	--	West Germany 48; Austria 22.
Refined, unalloyed	751	424	--	West Germany 152; United Kingdom 75.
Alloys	1,574	4,732	87	West Germany 3,535.
Semimanufactures	94,100	96,476	481	France 23,337; West Germany 15,067; Yugoslavia 7,406.
Gallium, indium, thallium metals, all forms ---kilograms	100	100	NA	NA.
Germanium metal including alloys, all forms	8	(1)	--	NA.
Iron and steel:				
Ore and concentrate except roasted pyrite	10,703	288	NA	NA.
Roasted pyrite	67,216	65,678	--	France 60,050; Austria 3,942.
Metal:				
Scrap---thousands tons	7	13	1	France 6; West Germany 6.
Pig iron, cast iron, spiegeleisen, powder, shot---do	17	22	--	West Germany 7; Netherlands 1; United Kingdom 1.
Ferroalloys---do	32	52	1	West Germany 22; France 9; Belgium-Luxembourg 4.
Steel, primary forms ---do	995	675	80	France 81; West Germany 59; Lebanon 53.
Semimanufactures:				
Bars, rods, angles, shapes, sections---do	3,753	3,282	8	West Germany 609; France 472; Saudi Arabia 315.
Universals, plates, sheets ---do	1,433	1,206	82	France 257; West Germany 166; U.S.S.R. 108.
Hoop and strip ---do	126	112	(1)	France 22; U.S.S.R. 16; Greece 12.
Rails and accessories ---do	23	20	(1)	Switzerland 6; Saudi Arabia 4.
Wire ---do	81	84	3	France 19; Algeria 9; West Germany 9.
Tubes, pipes, fittings ---do	1,831	1,515	64	U.S.S.R. 423; West Germany 165; Mexico 61.
Castings and forgings, rough ---do	5	10	--	France 2; West Germany 2.
Lead:				
Ore and concentrate	19,207	19,359	--	Greece 8,985; Austria 5,691; Bulgaria 2,352.
Ash and residue containing lead	7,920	12,862	--	France 6,782; Belgium-Luxembourg 5,921.
Oxide and hydroxide	1,936	720	--	West Germany 337; Hungary 227.
Metal including alloys:				
Scrap	95	257	--	Libya 192.
Unwrought	8,312	20,505	--	Belgium-Luxembourg 7,244; West Germany 5,751; Sweden 1,650.
Semimanufactures	653	377	--	Libya 122.
Magnesium metal including alloys:				
Scrap	638	596	90	France 198; West Germany 114.
Unwrought	4,795	5,375	--	West Germany 4,538.
Semimanufactures	290	193	--	France 126; West Germany 28.
Manganese:				
Ore and concentrate	30	5	NA	NA.
Oxide and hydroxide	4	117	NA	NA.
Metal including alloys, all forms	18	12	NA	NA.
Mercury ---76-pound flasks	22,394	9,512	4,180	West Germany 1,587; East Germany 1,001.
Molybdenum:				
Ore and concentrate	269	184	--	Austria 110; Netherlands 39.
Metal including alloys, all forms	20	36	--	Ivory Coast 14.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Matte, speiss, similar materials	--	10	NA	NA.
Metal including alloys:				
Scrap	161	299	11	India 152; West Germany 55; Switzerland 33.
Unwrought	100	226	--	Netherlands 155; Yugoslavia 48.
Semimanufactures	511	493	--	West Germany 71; Switzerland 62; Netherlands 45.
Platinum-group metals including alloys, unwrought and partly wrought thousand troy ounces	81	2,201	2,051	West Germany 21.
Rare-earth metals:				
Oxides and other compounds value	$379	$7,579	NA	NA.
Metals including alloys, all forms	141	106	--	Netherlands 50; United Kingdom 43.
Selenium, elemental kilograms	200	1,700	NA	NA.
Silicon, elemental	5,780	10,246	80	West Germany 3,902; United Kingdom 1,140; Japan 1,029.
Silver metal including alloys, unwrought and partly wrought thousand troy ounces	1,379	3,890	--	West Germany 1,042; Belgium-Luxembourg 138.
Tellurium and arsenic metals	(1)	5	NA	NA.
Thorium:				
Ore and concentrate kilograms	9,900	NA	NA	NA.
Thoria value	$656,170	--		
Tin metal including alloys, all forms	331	376	--	United Kingdom 67; France 55.
Titanium:				
Ore and concentrate	3	--		
Oxide and hydroxide	25,604	23,278	--	West Germany 2,774; Turkey 2,319; France 2,308.
Metal including alloys, all forms	137	125	24	West Germany 44; Belgium-Luxembourg 13; France 11.
Tungsten:				
Ore and concentrate value	--	$4,212	NA	NA.
Metal including alloys, all forms	33	98	--	West Germany 28; Algeria 9; France 9.
Vanadium:				
Oxide and hydroxide	56	1	NA	NA.
Metal including alloys, all forms	28	--		
Zinc:				
Ore and concentrate	32	2,364	--	Austria 2,325.
Matte, ash, residue containing zinc	18,783	14,473	--	France 7,510; West Germany 4,173; Sweden 2,550.
Oxide and hydroxide	3,154	3,105	--	West Germany 1,141; France 743; Hungary 300.
Metal including alloys:				
Scrap	1,445	1,418	--	West Germany 808; Belgium-Luxembourg 222; Switzerland 150.
Blue powder	602	288	--	Romania 200.
Unwrought	29,386	16,558	3,000	United Kingdom 3,860; Romania 3,006; France 2,585.
Semimanufactures	756	830	--	Switzerland 71; Morocco 52; West Germany 51.
Zirconium:				
Ore and concentrate	2,750	3,862	--	Hungary 3,440.
Metal including alloys, all forms	--	92	NA	NA.
Other:				
Ores and concentrates	171	1,379	--	France 834; West Germany 34.
Ash and residue containing nonferrous metals	6,346	12,432	--	France 6,666; West Germany 4,362.
Oxides, hydroxides, peroxides	2,860	322	--	France 70; Netherlands 54; United Kingdom 40.
Metal:				
Metalloids	--	2	NA	NA.
Alkali, alkaline-earth, rare-earth metals	312	440	NA	NA.
Base metals including alloys, all forms	10	13	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	294,561	210,292	32,982	United Kingdom 116,825; Algeria 37,425.
Dust and powder of precious and semiprecious stones kilograms	18	108	57	Switzerland 9.
Grinding and polishing wheels and stones	15,627	18,435	58	France 2,036; West Germany 1,596; U.S.S.R. 466.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Asbestos, crude	68,923	74,478	--	West Germany 23,794; Japan 7,916; Israel 7,050.
Barite and witherite	73,863	88,736	--	Algeria 41,200; Nigeria 9,650; Netherlands 6,540.
Boron materials:				
Crude natural borates	155	1,998	--	France 1,194; Yugoslavia 514.
Oxide and acid	4,444	6,300	2,357	West Germany 2,065; France 658; Austria 362.
Cement—thousands tons	1,585	1,695	--	Israel 265; Saudi Arabia 243; Libya 229.
Chalk	574	567	--	Zaire 59.
Clays and clay products:				
Crude clays:				
Bentonite	20,205	31,246	--	Libya 9,528; France 9,504.
Kaolin	42,546	29,490	--	France 22,128.
Other	7,725	9,485	--	Tunisia 2,771; West Germany 734.
Products:				
Refractory including nonclay brick	105,508	99,942	--	West Germany 15,475; Egypt 12,883; Romania 5,943.
Nonrefractory—thousand tons	2,365	2,878	136	West Germany 671; France 566; Saudi Arabia 109.
Cryolite and chiolite	2	(2)	NA	NA.
Diamond:				
Gem, not set or strung—carats	237	3 1,186	--	Venezuela 460.
Industrial—do	2,980	82,808	--	Netherlands 1,997.
Diatomite and other infusorial earths	1,185	1,866	--	U.S.S.R. 1,064.
Feldspar	28,808	37,601	--	West Germany 15,159; Greece 3,958; Algeria 3,929.
Fertilizer materials:				
Crude	7,836	6,797	--	France 3,679; Austria 1,582.
Manufactured:				
Nitrogenous—thousand tons	1,199	1,458	--	China, mainland 401; India 258; Turkey 256.
Phosphatic—do	7	2	--	Switzerland 1.
Potassic—do	107	105	--	Algeria 33; Greece 16; Turkey 15.
Other including mixed—do	385	335	--	West Germany 55; France 45; China, mainland 39.
Ammonia	47,208	16,927	--	Israel 9,462; Greece 3,841; Spain 2,819.
Fluorspar	60,952	55,080	36,255	Norway 7,600; Romania 3,000.
Graphite, natural	2,823	3,854	--	France 2,728; West Germany 438.
Gypsum and plaster	11,153	11,931	--	Switzerland 7,819.
Lime	124,561	96,437	--	Saudi Arabia 50,708; Switzerland 29,484.
Magnesite	131,459	151,740	--	West Germany 31,075; Austria 29,190; United Kingdom 20,953.
Mica:				
Crude including splittings and waste	800	661	--	West Germany 136.
Worked including agglomerated splittings	54	11	NA	NA.
Pigments, mineral including processed iron oxides	1,034	2,936	--	France 1,282; Spain 273; West Germany 250.
Precious and semiprecious stones except diamond:				
Natural—kilograms	r3,623	11,457	NA	NA.
Manufactured—do	442	548	--	France 19.
Pyrite (gross weight)	3,189	3,375	--	West Germany 1,689; France 556; Austria 501.
Salt, all forms	497,316	1,241,023	21,000	United Kingdom 672,595; Netherlands 200,896; West Germany 107,046.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	326,877	175,384	--	Yugoslavia 73,855; U.S.S.R. 15,150; Iraq 7,457.
Caustic potash	8	8	NA	NA.
Soda ash	15,934	20,190	NA	Algeria 11,862; Israel 4,008; Spain 3,296.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	337,475	372,621	--	Spain 56,500; Saudi Arabia 34,560; Lebanon 32,981.
Slate	3,168	3,320	NA	NA.
Other	108,667	118,988	57	West Germany 44,984; Austria 15,904; France 15,680.

See footnotes at end of table.

Table 2.—Italy: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dimension stone —Continued				
Worked:				
Slate	35,154	40,244	24,587	Austria 2,631; West Germany 922; Canada 850.
Paving and flagstone	95,775	131,317	--	West Germany 60,834; Switzerland 37,759.
Other	955,829	1,121,106	63,102	West Germany 454,180; Saudi Arabia 179,616; France 99,178.
Dolomite, chiefly refractory grade	29,670	47,317	--	France 15,546; Switzerland 4,646; West Germany 4,258.
Gravel and crushed rock	643,828	620,069	--	West Germany 109,304; Switzerland 95,857; Kuwait 81,145.
Limestone except dimension	72	10,995	NA	NA.
Quartz and quartzite:				
Piezoelectric crystal kilograms	30			
Other	37,798	36,220	--	Switzerland 18,383; France 12,376.
Sand excluding metal-bearing	434,043	420,108	--	Switzerland 369,621; Yugoslavia 30,626.
Sulfur:				
Elemental, all forms	3,797	190	NA	NA.
Sulfuric acid, oleum	81,097	36,043	--	Turkey 13,797; Greece 10,639.
Talc, steatite, soapstone	56,591	55,181	10,765	West Germany 9,989; United Kingdom 8,540; France 7,423.
Other:				
Crude	87,542	51,289	215	United Kingdom 25,115; Ireland 8,951; Switzerland 4,053.
Slag, dross, and similar waste, not metal-bearing	307,019	354,707	--	Yugoslavia 313,368.
Oxides, hydroxides, and peroxides of strontium, magnesium, barium	2,396	2,099	604	France 337; Iraq 240; Denmark 100.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	141,317	152,787	616	France 61,288; West Germany 12,466.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6,018	2,385	NA	NA.
Carbon black and gas carbon	39,493	44,989	--	Yugoslavia 13,796; Austria 9,900; France 9,729.
Coal, all grades, including briquets	5,554	13,074	--	France 6,288; Switzerland 5,126.
Coke and semicoke	625,167	645,114	89,846	Romania 152,690; Algeria 118,914; Spain 73,146.
Gas, natural thousand cubic feet	502	1,426	NA	NA.
Peat including briquets and litter	730	644	NA	NA.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	66,590	59,882	2,672	Netherlands 17,113; France 7,888; United Kingdom 5,833.
Kerosine do	22,310	22,951	926	Netherlands 3,600; Greece 2,122; United Kingdom 2,078.
Distillate fuel oil do	49,721	47,197	--	Netherlands 13,412; Syria 4,040; Switzerland 2,869.
Residual fuel oil do	57,550	49,311	4,514	Netherlands 4,886; Turkey 4,809; France 3,059.
Lubricants do	3,298	3,648	1	Belgium-Luxembourg 494; West Germany 345; Algeria 293.
Other:				
Liquefied petroleum gas do	5,461	4,544	--	Egypt 824; Algeria 747; Portugal 454.
Mineral jelly and wax do	18	25	--	Vietnam 9; West Germany 4.
Bitumen and other residues do	1,228	904	--	Austria 403; Tunisia 175; Switzerland 121.
Bituminous mixtures do	46	42	--	Sudan 9; Tunisia 6.
Petroleum coke do	r180	234	--	Egypt 188; Spain 13.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r79,029	62,587	--	France 38,033; West Germany 8,599; Yugoslavia 5,845.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Unreported quantity valued at $1,388.
[3]Excludes an unreported quantity valued at $1,384.

Table 3.—Italy: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate thousand tons	1,645	2,287	--	Australia 1,670; Guinea 389.
Ash and residue containing aluminum	61,782	62,260	--	Austria 44,536; France 7,367.
Oxide and hydroxide	166,841	179,690	370	Guinea 114,382; France 17,076.
Metal including alloys:				
Scrap	41,448	57,754	7,308	West Germany 13,917; Switzerland 10,360; France 9,209.
Unwrought	231,849	276,281	1,499	West Germay 81,885; France 46,213; Netherlands 23,213.
Semimanufactures	62,312	92,114	7,706	West Germany 34,549; France 22,002; Belgium-Luxembourg 13,073.
Antimony metal including alloys, all forms	152	121	--	Belgium-Luxembourg 56.
Arsenic trioxide, pentoxide, acid	r785	820	--	Belgium-Luxembourg 396; France 340.
Beryllium metal including alloys, all forms kilograms	1,700	1,400	NA	NA.
Bismuth metal including alloys, all forms	61	55	--	United Kingdom 11.
Cadmium metal including alloys, all forms	179	85	--	West Germany 30.
Chromium:				
Chromite	140,186	232,445	--	Turkey 104,960; Republic of South Africa 51,474; Albania 40,374.
Oxide and hydroxide	1,357	2,202	--	West Germany 1,642; Hungary 255.
Metal including alloys, all forms	206	206	--	West Germany 64; France 37; United Kingdom 33.
Cobalt:				
Oxide and hydroxide	214	189	--	Belgium-Luxembourg 149; France 30.
Metal including alloys, all forms	369	338	23	Belgium-Luxembourg 126; France 77.
Columbium and tantalum metals including alloys, all forms	9	26	4	West Germany 2.
Copper:				
Ore and concentrate	16	10	NA	NA.
Cement copper kilograms	54,100	400	NA	NA.
Sulfate	3,213	3,063	--	Austria 780; Czechoslovakia 730; France 597; Yugoslavia 500.
Ash and residue containing copper	227	670	NA	NA.
Metal including alloys:				
Scrap	69,579	76,310	--	West Germany 22,045; France 21,050; United Kingdom 18,309.
Unwrought:				
Blister	4,654	6,802	100	Chile 5,440; Yugoslavia 472.
Refined, unalloyed	351,646	338,464	--	Chile 89,178; Zambia 63,061; Belgium-Luxembourg 31,947.
Alloys	14,447	17,067	366	Yugoslavia 4,592; West Germany 4,370; United Kingdom 2,620.
Semimanufactures	69,492	107,552	522	France 32,162; West Germany 30,828; Belgium-Luxembourg 10,974.
Gallium, indium, thallium metals including alloys, all forms kilograms	1,000	1,200	--	Canada 500; Belgium-Luxembourg 300.
Germanium metal including alloys, all forms do	100	200	--	Belgium-Luxembourg 100.
Iron and steel:				
Ore and concentrate thousand tons	16,297	17,318	212	Brazil 4,006; Canada 2,381; Liberia 2,234.
Roasted pyrite	173	2,800	NA	NA.
Metal:				
Scrap thousand tons	6,566	6,891	871	France 2,651; West Germany 2,092.
Pig iron, cast iron, spiegeleisen do	347	517	--	France 140; West Germany 112; Sweden 82.
Sponge iron, powder, shot do	68	119	--	Canada 46; Venezuela 31; Sweden 17.
Ferroalloys:				
Ferromanganese do	106	122	--	Republic of South Africa 45; France 45; West Germany 13.
Other do	187	220	1	France 32; Norway 26; Yugoslavia 20.
Steel, primary forms do	2,210	3,061	(1)	France 648; Belgium-Luxembourg 480; West Germany 296.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	584	768	1	France 260; West Germany 130; Austria 84.
Universals, plates, sheets do	1,255	1,822	77	France 516; Belgium-Luxembourg 318; West Germany 220.
Hoop and strip do	165	209	1	France 72; West Germany 67; Belgium-Luxembourg 26.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Rails and accessories thousand tons	139	139	--	France 37; West Germany 26; Belgium-Luxembourg 17.
Wire ---------- do	54	66	(1)	Belgium-Luxembourg 27; France 13; West Germany 11.
Tubes, pipes, fittings do	169	282	2	West Germany 107; France 96; Sweden 12.
Castings and forgings, rough do	5	8	--	West Germany 4; France 2.
Lead:				
Ore and concentrate	18,589	45,365	--	Canada 23,613; Morocco 10,528; Greece 8,060.
Ash and residue containing lead	8,555	4,038	--	West Germany 1,706; Netherlands 644; Belgium-Luxembourg 424.
Oxide and hydroxide	3,671	4,829	--	Netherlands 3,667; West Germany 569.
Metal including alloys:				
Scrap	38,275	48,707	--	France 21,670; United Kingdom 8,491.
Unwrought	138,318	151,411	871	West Germany 42,088; Australia 17,917; Republic of South Africa 16,234.
Semimanufactures	974	1,538	--	Yugoslavia 1,065.
Magnesium metal including alloys:				
Scrap	2,251	1,746	--	West Germany 766; Netherlands 316; Austria 240.
Unwrought	1,032	1,649	392	Netherlands 626; Norway 476.
Semimanufactures	327	263	181	United Kingdom 28; Switzerland 24.
Manganese:				
Ore and concentrate	284,319	424,230	--	Republic of South Africa 181,483; Gabon 179,582; Brazil 38,974.
Oxide and hydroxide	2,850	3,219	--	Belgium-Luxembourg 1,054; Greece 921; France 548.
Metal including alloys, all forms	1,165	1,886	--	Republic of South Africa 957; France 791.
Mercury ---------- 76-pound flasks	1,297	2,321	--	Algeria 1,021.
Molybdenum:				
Ore and concentrate	5,637	5,866	807	Netherlands 4,069; Belgium-Luxembourg 511; Canada 351.
Metal including alloys, all forms	176	240	64	Austria 81; Netherlands 56.
Nickel:				
Matte, speiss, similar materials	7,537	5,727	--	Canada 2,960; Cuba 1,804.
Metal including alloys:				
Scrap	299	314	9	Norway 174; Republic of South Africa 50.
Unwrought	11,912	16,595	4,000	Republic of South Africa 3,527; Netherlands 2,042; Australia 1,834.
Semimanufactures	2,313	2,811	239	United Kingdom 868; West Germany 832; France 188.
Platinum-group metals including alloys, unwrought and partly wrought thousand troy ounces	455	580	3	Republic of South Africa 299; West Germany 159; United Kingdom 47.
Rare-earth metals:				
Oxides and other compounds value, thousands	$795	$966	--	France $784; Austria $155.
Metals, all forms	122	117	--	West Germany 76; Brazil 10; United Kingdom 10.
Selenium, elemental	21	39	6	Canada 7; Japan 7.
Silicon, elemental	5,579	17,701	--	Yugoslavia 8,459; France 2,320.
Silver metal including alloys, unwrought and partly wrought thousand troy ounces	31,768	25,068	6,257	United Kingdom 6,990; West Germany 3,385; Switzerland 1,707.
Tellurium and arsenic metals	78	63	14	Sweden 47.
Thorium:				
Ore and concentrate	20	NA	NA	NA.
Thoria ---------- value	$7,486	$9,857	NA	NA.
Tin:				
Ore and concentrate	--	508	--	All from Austria.
Metal including alloys:				
Scrap ---------- kilograms	--	900	NA	NA.
Unwrought	6,426	7,107	--	Indonesia 2,601; Malaysia 2,547; Thailand 726.
Semimanufactures	214	410	--	West Germany 192; United Kingdom 67.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	126,428	82,166	--	Australia 59,968; Norway 18,367.
Oxide and hydroxide	44,716	43,552	3,459	West Germany 15,825; France 9,911.
Metal including alloys, all forms	2,769	2,856	690	Austria 1,075; West Germany 325.
Tungsten:				
Ore and concentrate	126	181	--	Canada 126; China, mainland 35.
Metal including alloys, all forms	124	144	6	West Germany 57; United Kingdom 26.
Uranium metal including alloys, all forms kilograms	300	1,800	NA	NA.
Vanadium:				
Ore and concentrate	1,798	449	NA	NA.
Oxide and hydroxide	1,009	864	95	Austria 556; Republic of South Africa 134.
Metal including alloys, all forms kilograms	2,000	300	NA	NA.
Zinc:				
Ore and concentrate	206,600	232,587	--	Canada 64,070; Peru 49,412; Ireland 39,243.
Matte, ash, residue containing zinc	6,665	13,706	2,054	West Germany 6,720; Switzerland 2,584.
Oxide and hydroxide	2,248	2,525	--	Netherlands 986; France 778; West Germany 426.
Metal including alloys:				
Scrap	1,710	4,022	--	France 1,234; West Germany 1,150; Switzerland 778.
Blue powder	444	332	--	Norway 130.
Unwrought	54,043	56,496	--	West Germany 15,165; Belgium-Luxembourg 11,258; Netherlands 7,304.
Semimanufactures	2,038	3,047	--	West Germany 1,618; France 724; Belgium-Luxembourg 529.
Zirconium:				
Ore and concentrate	42,209	67,273	--	Australia 57,325; Republic of South Africa 4,560.
Metal including alloys, all forms kilograms	24,200	12,000	1,500	NA.
Other:				
Ores and concentrates	508	858	--	Australia 180.
Ash and residue containing nonferrous metals	15,417	34,090	--	Republic of South Africa 18,255; West Germany 1,324; France 1,685.
Oxides, hydroxides, peroxides	7,725	8,680	37	Cuba 2,914; West Germany 1,864; France 755.
Metals:				
Metalloids	1	45	NA	NA.
Alkali, alkaline-earth, rare-earth metals	6,573	4,862	--	West Germany 3,648.
Base metals including alloys, all forms	5	68	--	West Germany 41.
NONMETALS				
Abrasives, natural, n.e.s.:				
Natural: Pumice, emery, corundum, etc	3,551	2,138	--	West Germany 316; Yugoslavia 245.
Dust and powder of precious and semiprecious stones kilograms	1,111	1,421	757	Ireland 514.
Grinding and polishing wheels and stones	3,689	4,463	115	Austria 1,946; West Germany 556; United Kingdom 541.
Asbestos, crude	47,189	77,151	--	Republic of South Africa 38,935; Canada 25,044.
Barite and witherite	13,871	13,634	36	Spain 5,923; France 5,625.
Boron materials:				
Crude and natural borates	186,803	172,792	20,972	Turkey 131,264.
Oxide and acid	843	1,622	426	Turkey 700; U.S.S.R. 199.
Cement	67,729	73,158	--	France 16,087; Libya 14,871; Algeria 11,549.
Chalk	15,235	14,958	--	France 14,517.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products:				
Crude clays:				
Bentonite	54,673	29,912	972	Greece 20,626; Turkey 2,850; West Germany 2,580.
Kaolin	673,576	767,542	223,293	United Kingdom 344,304; West Germany 82,138.
Other	579,406	741,827	4,477	West Germany 329,188; France 234,476.
Products:				
Refractory including nonclay brick	80,571	92,087	2,840	West Germany 29,254; Austria 15,814; United Kingdom 14,378.
Nonrefractory	20,940	32,140	--	West Germany 13,688; Switzerland 8,910; France 6,316.
Cryolite and chiolite	1,226	475	--	Denmark 394.
Diamond:				
Gem, not set or strung carats	99,360	155,305	--	Belgium-Luxembourg 86,907; Israel 29,401.
Industrial do	190,374	184,340	--	Belgium-Luxembourg 70,761; Republic of South Africa 51,910.
Diatomite and other infusorial earths	5,391	5,912	845	West Germany 2,774; France 1,279.
Feldspar	29,143	40,561	--	Canada 21,385; Norway 10,390; West Germany 3,776.
Fertilizer materials:				
Crude:				
Nitrogenous	3,539	3,353	--	Belgium-Luxembourg 2,597.
Phosphatic thousand tons	1,619	1,625	361	Morocco 676; Israel 339.
Potassic	19,153	22,316	--	France 20,114.
Other including mixed	3,911	3,202	--	France 1,880.
Manufactured:				
Nitrogenous	127,327	142,524	53	Austria 44,407; France 26,989.
Phosphatic	110,643	152,638	22,420	Tunisia 49,989; France 41,400.
Potassic	531,169	742,987	11,961	U.S.S.R. 208,808; Israel 184,072; East Germany 144,362.
Other including mixed thousand tons	810	1,182	951	Yugoslavia 52; West Germany 38; Austria 28.
Ammonia	229,592	307,114	--	U.S.S.R. 249,418; Libya 30,274.
Fluorspar	46,973	78,717	--	Spain 45,331; France 13,594.
Graphite, natural	5,535	4,691	--	West Germany 2,139; Austria 905.
Gypsum and plaster	17,960	16,177	905	Austria 12,888.
Lime	466	264	NA	NA.
Magnesite	66,904	86,270	--	Greece 59,924.
Mica:				
Crude including splittings and waste	1,246	1,024	--	India 234.
Worked including agglomerated splittings	330	360	--	Belgium-Luxembourg 129; Spain 76; France 75.
Pigments, mineral: Processed iron oxides	17,730	20,440	449	West Germany 14,196.
Precious and semiprecious stones except diamond:				
Natural kilograms	r81,671	123,817	2,796	Brazil 74,349; West Germany 8,427; Hong Kong 1,342.
Manufactured do	11,312	8,573	--	France 3,745; Switzerland 3,074.
Pyrite, gross weight	247,158	286,351	--	U.S.S.R. 283,204.
Salt	195,252	240,244	72,909	France 134,923; Poland 123,948.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	69,242	96,972	9,397	France 37,606; West Germany 30,471; Norway 7,297.
Caustic potash	1,370	2,194	NA	West Germany 846; Yugoslavia 275; Spain 203.
Soda ash	83,349	85,024	NA	U.S.S.R. 29,752; Romania 14,704; Switzerland 7,805.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous including marble	133,696	154,843	--	Spain 31,809; Portugal 30,700; Yugoslavia 28,892.
Slate	2,521	3,339	--	France 3,108.
Other	293,949	385,477	--	Spain 76,079; Finland 67,985; Republic of South Africa 67,974.
Worked, all forms	4,119	4,262	NA	NA.
Dolomite, chiefly refractory grade	872	1,024	NA	NA.
Gravel and crushed rock	8,736	13,222	--	France 5,382; West Germany 3,601.
Limestone except dimension	1,003	388	NA	NA.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Quartz and quartzite:				
Piezoelectric crystals kilograms	149	5,910	--	West Germany 4,176.
Other	42,995	45,054	--	Switzerland 31,659; West Germany 8,126.
Sand excluding metal-bearing thousand tons	1,067	1,188	--	France 716; Belgium-Luxembourg 348.
Sulfur:				
Elemental:				
Other than colloidal	606,051	754,861	72,909	Canada 380,384; France 134,992; Poland 123,948.
Colloidal	1,573	1,591	--	West Germany 1,323.
Sulfuric acid	44,567	41,682	--	United Kingdom 21,533; Portugal 7,325.
Talc, steatite, soapstone	18,892	21,790	--	Austria 12,491; France 4,224; United Kingdom 3,821.
Other:				
Crude	64,459	87,507	2,931	U.S.S.R. 20,327; Republic of South Africa 13,648; Turkey 10,800.
Slag, dross, similar waste, not metal-bearing	17,344	5,507	--	Austria 3,038; France 917.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	758	923	287	West Germany 314; United Kingdom 144.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	21,374	32,552	1,783	France 15,246; Austria 2,802; Hungary 2,116.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,140	1,788	1,318	NA.
Carbon black and gas carbon	22,286	29,934	1,782	France 16,141; Spain 2,832; West Germany 2,084.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	11,736	13,865	4,174	Poland 3,030; Republic of South Africa 2,325; West Germany 1,862.
Briquets of anthracite and bituminous coal	1,187	1,224	--	West Germany 1,197.
Lignite including briquets	64,847	88,111	--	Yugoslavia 41,658; West Germany 39,193.
Coke and semicoke	128,430	168,450	14,077	France 76,385; West Germany 51,948; Yugoslavia 15,169.
Gas, natural:				
Gaseous ---- million cubic feet	410,132	462,432	--	U.S.S.R. 292,117; Netherlands 170,315.
Liquefied thousand 42-gallon barrels	19,845	20,087	--	Libya 19,855.
Peat including briquets	34,330	35,222	--	U.S.S.R. 21,550; West Germany 6,902.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	787,215	806,191	--	Saudi Arabia 234,605; Iraq 163,157; Libya 115,792.
Refinery products:				
Gasoline ---- do	16,187	12,231	4	Libya 2,225; Israel 2,037; Republic of South Africa 1,528.
Kerosine ---- do	1,592	1,014	--	Trinidad and Tobago 463; Libya 332; Netherlands 116.
Distillate fuel oil ---- do	9,222	4,640	--	U.S.S.R. 998; Romania 592; Israel 485.
Residual fuel oil ---- do	43,592	57,746	--	Kuwait 10,468; Venezuela 9,141.
Lubricants ---- do	572	880	112	France 175; United Kingdom 141; West Germany 104.
Other:				
Liquefied petroleum gas do	2,985	3,004	--	West Germany 467; Saudi Arabia 376; Indonesia 369.
Mineral jelly and wax do	285	343	--	West Germany 132; Hungary 59; Netherlands 27.
Bitumen and other residue do	966	1,784	1,539	Albania 197.
Bituminous mixtures do	10	11	1	France 5.
Petroleum coke ---- do	r3,374	4,666	3,214	U.S.S.R. 567; United Kingdom 291.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r335,190	367,480	105,423	France 74,759; Yugoslavia 37,884; West Germany 12,274.

rRevised. NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Although without any significant production of bauxite, Italy was an important producer of alumina and aluminum metal during 1980.

Planning for the expansion of the large alumina plant at Porto Scuso in Sardinia, owned by Euroalumina, slowed down; reportedly the idea of expansion was abandoned during the last part of the year.

The Societa Aluminio Veneto per Azioni and Lavorazione Leghe Leggere decided to merge. It will be known as Sava-Aluminio-Veneto. The new company will operate two primary aluminum smelters (Fusina and Porto Marghera), with a total annual capacity of 60,000 tons, and plants near Milan for production of 100,000 tons per year of aluminum semimanufactured products, 10,000 tons per year of aluminum foil, and 7,000 tons per year of "rolbond." The total work force should be 3,200 persons and annual value of sales should reach an equivalent of US$270 million.

A small output of bauxite came from mines at Palmarigi, Otranto, and Poggiardo in the Puglia region owned by the Societa Mineraria Montevergine. Most of the domestic bauxite was used by the cement industry.

Iron and Steel.—Italsider Mines on the Island of Elba continued production during 1980. In the Ginevro Mine the northern part of the deposit was exhausted. Rumors regarding planned shutdown of mines on Elba caused strong protest from both local authorities and trade unions. In response, the Italsider group confirmed that the mining will continue up to the expiration of its concession at the end of 1981.

A proposal for reorganization of Italy's state-owned steel group, Finsider, was made public at the end of 1980. The plan aims to form three groups of operating companies, Italsider, Piombino, and Societa Italiana Acciai Speciali (SAIS). Italsider would be considerably slimmed down and would be essentially a flat rolled steel producer, with perhaps a change of name. Piombino would take over two plants operated by Italsider (the San Giovanni Valdarno and Marghera works), thus becoming the largest producers of rails and sections in Italy. The SAIS, Finsider's sales agency, was scheduled to take over ownership and operations of the special steelworks of Breda and Cogne. Approval from the authorities for this reorganization was expected sometime in 1981.

At San Zeno Naviglio, south of the city of Brescia, north Italy, the Seta S.p.A., an affiliate of Pietra Acciaierie Ferriere Tubifici S.p.A., started operation of a 500,000-ton-per-year electric arc and continuous caster for rounds of 200 to 450 millimeters.

At Italsider's Cornigliano plant, near Genoa, a new continuous slab caster went into operation in the second half of 1980. The new unit had a capacity of 1.2 million tons per year of slabs 4 to 8 meters long. In addition, at Cornigliano, in the second quarter of the year, the modernization and rebuilding of the coke oven battery No. 1 was completed. The 30-oven battery was fully onstream at the end of May. Furthermore, at Cornigliano, reconstruction of the No. 2 blast furnace was completed in the first half of 1980. Reportedly, after reconstruction, consumption of energy at blast furnace No. 2 was lower than it was before remodeling. The No. 2 furnace has an 8.6-meter hearth diameter and has a daily capacity of about 3,000 tons.

The leading private sector steel producer, Falck, decided to build a continuous casting installation based on technology developed by the Société des Etudes de Centrifugation, a subsidiary of the French steel producers, Creusot-Loire and Vallourec. The new four-strand caster should produce 180,000 to 200,000 tons per year of steel rounds of various sizes. Startup was planned for the latter part of 1981.

Lead and Zinc.—During 1980, lower mine production of lead and zinc resulted from the closure of several mines and drop in grade of mined ores. The Salafossa Mine, owned by Pertusola, located near Santo Pieto di Cadore, Province of Belluno, was closed in August because a large landslide destroyed the mine's flotation plant. At yearend the mine remained closed. At Monteponi Mine, owned by SAMIM, located near Inglesia, Province of Cagliari, Sardinia, production from the low-grade ore body was reduced and preparation for dewatering the 200-meter level was underway during 1980. In addition, reconstruction of the mine's flotation plant had begun, but details were withheld.

The Fontana Ramirosa Mine, owned by

SAMIM and located in Sardinia, was closed for ecological reasons. A new flotation plant, with technology that will offer better protection to the environment, was under construction during 1980. Preparatory work for opening a new mine in the area continued. Montevecchio Mine, owned by SAMIM, located at Guspini, Province of Cagliari, Sardinia, was closed during the year to evaluate the results of experiments in mining with cement slurry back filling.

The Arenas Mine, owned by the Piombo Zinzifera Sarda S.p.A., located in Sardinia, was closed for 4 months because of a major repair of the flotation plant.

A decision was made to start modernization and expansion of the zinc plant at Porto Vesme in Sardinia, to a capacity of 75,000 tons of metal per year. Three obsolete smelters, Ponte Rosa, Porto Marghera, and Monteponi, were not closed during 1980, but reports indicated all of them may be converted to producers of secondary metal.

SAMIM announced future production goals. By 1983, SAMIM plans to produce 95,000 tons of lead and zinc concentrates, as well as 160,000 tons of smelter zinc, and 130,000 tons of smelter lead per year.

Titanium.—The Societa Amiantifera del Balangero of Turin and Societa Mineraria Italiana have obtained a concession to develop a titanium deposit at Pian Paludo, near Novara, which according to reports, is of high commercial value. No other details on the deposit were made public.

No development has taken place on the large titanium ore deposit on Mount Beigua, near Varazze west of Genoa. The Beigua deposit is rutile with a titanium metal content of up to 7%. Reserves were estimated at 50 million tons, from which 2.5 million tons of rutile may be recovered. Ecological problems have delayed development since its discovery in 1977. The deposit is located in an untouched area of the Liguria coast and mining might mean destruction of one of the country's few remaining natural landscapes. Opposition to mining was strong but the consortium stated that with advanced, but costly, technology both conservation and mining of minerals can be achieved.

NONMETALS

Barite.—Bariosarda Co., a state-owned entity, and Edem Co. and Mineraria Baritina S.p.A., both private, controlled the country's barite output during 1980. Exploration programs were underway in the Arcu Sa Cruzi, Sa Bagatu, Seddorgia Barega, and Mont'Ega Mines in Sardinia, all operated by Bariosarda Co., leading to the discovery of some additional reserves. Bariosarda has increased its capacities for desliming and crushing barite to 1,000 tons per day at the Barega and Mont'Ega Mines.

Fluorspar.—Fluorspar was mined by two private companies, Mineraria Silius and Fluoramine in northern Italy, Sardinia, and Latium. Mineraria Silius, with mines at Gennas, Tres Montes, and Miscandroxiu in Sardinia, was by far the largest producer of fluorspar and accounted for approximately two-thirds of the country's output; in the area of the Silus mines in Sardinia, work on a central shaft for several mines continued and conversion to full mechanization was underway during 1980.

The completion of the Pianciano fluorspar mine and plant located in the Province of Lazio, about 34 kilometers northwest of Rome, was delayed because of slow delivery of equipment. The operator, Soucom S.p.A., a fully owned subsidiary of Southland Mining Ltd. of Australia, expected start of production in 1981.

Magnesium.—Societa Italiana per il Magnesio e Leghe di Magnesio, which operated a 12,000-ton-per-year magnesium plant at Bolzano, announced the possibility of stopping production. High costs for power and lower demand for magnesium made the operations uneconomic. The future of the plant depended on the results of continuing power tariff negotiations.

Potash.—Reduced potash production in Sicily resulted from lower output of the San-Cataldo-Palo Mine, where reserves were near exhaustion, and from closure of the Racalmuto Mine for repair of the main shaft.

At the Milena Mine, development work continued. About 300 meters of inclined truck ramp as well as buildings for powerplants, offices, warehouses, and repair shops were completed. Reportedly, the new mine would become operational some time during 1982 or 1983. Exploration by drilling continued to determine whether the Milena Mine is connected with the Vallone potassium-salts bearing basin. If the connection exists, a third plant for the conversion of the kainite ore to potasium sulfate may be built. All ore mined in Sicily was principally kainite.

Pyrite.—At a Campiano mine (Grosseto), operated by Solmine S.p.A., a service ramp for trucks that joins the 240 level below the sea level with the surface was completed. During 1980, Solmine S.p.A. produced all of the pyrite in Italy. Pyrite was consumed in

a sulfuric acid plant and pyrite cinder was used in a plant for production of iron pellets. Both plants were operated by Solmine.

MINERAL FUELS

In the fall of 1980, the revision of the National Energy Plan was completed. The draft of the plan was sent to the Council of Ministers for approval but was withdrawn for further study before yearend. It was expected that the Parliament would act on the energy plan during 1981.

Italy was dependent on imports of high-rank coals, crude oil, and natural gas to meet its energy demand. The major domestic source of energy was natural gas, followed by hydropower and a modest output of lignite, but even natural gas imports amounted to 53% of the country's consumption.

Coal.—Exploration around the Santa Barbara lignite mine near Arezzo confirmed the existence of an additional 2 million tons of lignite in the area.

The Italian Government, Carbosulcis (owned by the Sardinian Regional Government), and SAMIM continued to work on reopening of the Sulcis Coalfield in Sardinia. The authorities were planning a two-prong approach to reopening the Sulcis Mine. At first the old mine will be reopened and the coal will be used in power-generating installations in Sardinia. To minimize pollution, the high-sulfur Sulcis coal will probably be mixed with low sulfur imported coal before it is used in powerplants. Over the long term, the Government and ENI were exploring technologies that could be used to gasify and liquefy Sulcis coal. Imports of coal were essential to meet the country's energy demand. During the past 3 years, use of coal in Italy was increasing, reflecting efforts by the Government to lower the use of imported and expensive crude oil.

Natural Gas.—Although natural gas was the largest primary energy source produced in the country, Italy was chiefly dependent on imports to meet demand during 1980. Construction of the Trans-Mediterranean gas pipeline from Rassi R'mel in Algeria to Minerbio near Bologna in Italy continued. The first of the three underwater pipelines between Algeria and Sicily, Italy, were laid down. The first flow of gas was planned for 1981, providing agreement is reached on the price.

A new onshore gasfield was discovered near Ravenna by ENI. ENI expects to discover wells that produce 300 million cubic meters of gas per year. Near Ravenna, ENI also has 15 offshore platforms with 118 wells in operation.

Another deposit of natural gas was discovered offshore Gyevi, near San Benedetto del Tronto, a port on the Adriatic Sea. Tests on the first well indicated a possible daily production of about 0.25 million cubic meters. At yearend, further drilling was underway to determine the size and economic potential of the deposit.

In addition, Societa Viscosa announced a natural gas strike at Biccari near Foggia (Puglia). Preliminary reports indicated dry gas (99% methane) at pressures up to 200 atmospheres. Depth of the pay zone was 2,400 meters.

Petroleum.—During 1980, exploration for petroleum continued but no major discoveries were announced. The number of exploration permits decreased compared with those of previous years. However, the apparent decline in these activities does not reflect the interests of domestic and foreign companies in exploration in Italy because they do not include permits granted in offshore Zone F. AGIP and Texaco Inc. jointly requested 16 oil exploration permits covering 1.1 million hectares, including all of the Puglia region and parts of Zone F. AGIP started exploration offshore in an area located between Marsala, Sicily, and Pantellaria Islands, and plans were made to explore the Sicilian mainland as soon as necessary permits were granted by the regional government.

With a total output of 97 million tons, Italian refineries had a low rate of utilization during 1980, probably about 60%; a major reason, in addition to low demand, was the imposition of Government regulations requiring export licensing for reexport of products, which made processing of crude less advantageous in Italy than in other European processing centers.

Mediterranea Raffineria Petroli S.p.A. of Messina, a subsidiary of the largest Italian independent oil group, owned by Attilio Monti, became insolvent and the Ministry of Industry appointed a commission to find a solution to its problems. One measure taken was to revoke the operating permits of the company's four refineries, which had an annual capacity of 37 million tons. In addition ENI, after negotiations, took over the group's SAROM company, with a refinery at Ravenna. At yearend, ENI was negotiating to take over the rest of the group.

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The Mineral Industry of Japan

By John C. Wu[1]

Despite the sluggish domestic demand and the continuing rise in oil prices in 1980, Japan's economy successfully achieved a 4.2% growth in real gross national product (GNP). According to the Economic Planning Agency, Japan's real GNP in 1975 constant yen, increased from 181,740.8 million yen in 1979 to 189,431.4 million yen in 1980. An increased investment on plant and equipment by industry and a high rate of export earnings were cited as the major contributing factors to the growth of Japan's GNP in 1980. During the 1979-80 period, the wholesale price index rose by 17.8%, and the consumer price index increased by 8.0%. However, the unemployment rate was kept at 2.0% of the 56.5 million labor force throughout 1980.

Since the 1973 energy crisis, Japan has been investing heavily in plant and equipment designed mainly for energy- and labor-saving purposes. Investment in machinery and equipment, consistently accounting for 15% of Japan's GNP during the 1975-78 period, rose 16% to 17% of the GNP during the 1979-80 period. As a result, labor productivity of the Japanese industry has increased rapidly during the past 4 years. An increase in labor productivity has strengthened the Japanese industry's competitive position in the world market, as well as sustained a high rate of export earnings.

According to Japan's Productivity Research Institute, labor productivity indexes for all industries, as well as selected mining- and mineral-related manufacturing industries for the 1977-80 period, with 1975 as a base year, were as follows:

	1977	1978	1979	1980
Industry	117.6	126.9	141.9	154.6
Mining	112.6	123.0	125.1	124.9
Coal	102.6	106.3	106.1	112.3
Metal	117.9	130.0	136.2	143.1
Nonmetal	124.2	149.6	160.6	148.3
Crude petroleum and natural gas	112.8	113.5	102.9	100.1
Manufacturing	118.0	127.4	142.8	156.0
Iron and steel	114.1	121.4	140.1	145.9
Nonferrous metal	132.1	148.3	161.4	162.4
Stone, clay, glass products	119.7	131.2	144.7	150.2
Chemical	120.5	136.9	153.2	157.7

In stabilizing prices, Japan has successfully controlled the growth in labor productivity in excess of the growth in wage cost.

According to the Metal Mining Agency of Japan, the number of mines under operation and the number of employees for metal and nonmetal mining in 1973, 1975, 1977, and 1979 were as follows:

Year as of April 1	Number of mines		Number of employees	
	Metal	Nonmetal	Metal	Nonmetal
1973	139	898	22,913	23,318
1975	107	828	19,037	22,224
1977	96	754	16,914	20,168
1979	79	730	12,551	18,967

Scarce resources, declining ore grades, high labor costs, and rigid Government environmental restrictions were the major factors for the decline of the Japanese mining industry over the past 7 years. However, the limestone mining industry of Japan remained one of the world's largest in 1980. Japan continued to be a significant

producer of lead and zinc in the world. However, Japan's coal mining industry, despite a moderate gain in labor productivity, was unable to expand and achieve its 20-million-ton-per-year goal.

Japan continued to be among the world's significant producers of cement, iron and steel, ferroalloys, fertilizer, nonferrous metals, and petroleum products. However, Japan is dependent on overseas sources for most of its major minerals. For example, dependency of iron ore on imports was about 98.5% in 1980; copper ore, 97.5%; bauxite, 100%; coking coal, 89%; phosphate rock, 100%; and crude petroleum, 99.8%. To secure stable sources of imports, most of Japan's major minerals were imported under a long-term contract or received through overseas minerals development by investment (equity participation) and by technological assistance in exploration.

During 1980, a multimillion-dollar Amazon aluminum project was signed with Brazil, a joint venture project agreement was reached with China for development of a major copper mine near Tongling in Anhui Province, and a joint venture company was established with Peru for exploration of lead and zinc in central Peru. Major long-term coal contracts were signed in 1980 with Australia and Canada. Japan also signed two major joint venture agreements; one with Australia and the other with China to develop steam coal mines. In oil exploration and development, Japan signed two major contracts with China to develop the oil resources in Bo Hai Bay. Japan also signed an agreement with Canada to develop the oil deposits of Beaufort Sea in the Arctic. In addition to the existing overseas sources of its liquefied natural gas (LNG), Japan secured two 20-year supply contracts from Canada and the Soviet Union. A major long-term uranium purchase contract was also signed by Japan and Australia.

Japan's direct overseas investment in fiscal year (FY) 1979 totaled $4,995 million, according to the Ministry of Finance. The figure represented an 8.6% increase over the previous fiscal year, and was about 0.5% of the country's GNP. Since FY 1951, Japan's cumulative direct overseas investments were $31,804 million by FY 1979. The share of investments in North America, Latin America, and Oceania increased from 49.8% of the outstanding balance for 1951-79 to 64.6% of the overseas investments for FY 1979, while the share of Asia, the Middle East, and Africa decreased from 37.9% to 25.5%. Other new characteristics of Japan's overseas investments for FY 1979 were a sharp increase in the form of credit acquisitions and a significant increase in investments in natural resources.

Japan's overall foreign economic assistance in FY 1979 totaled $7.6 billion, down 29% from $10.7 billion recorded in 1978, according to the Ministry of International Trade and Industry (MITI). However, the Japanese Official Development Assistance (ODA) in FY 1979 totaled $2.6 billion, representing a 19.1% increase over the previous year. ODA funds were distributed as follows: $560.2 million was for financial grants and technical assistance, $1,361 million was for development lending and capital, and the remainder was for contributions to multilateral institutions. According to a MITI white paper released in late 1980, Japan would provide economic assistance to the developing nations because of its need in securing a stable supply of oil and other energy resources.

During the past 5 years, exports of chemicals and heavy industry products (such as machinery, electric power machinery and equipment, and motor vehicles) have been rising in terms of quantity as well as unit value. Concomitantly, exports of light industry products (such as textiles, wood products, and foodstuffs) were on the decline. Imports of intermediates (such as fabrics, refined metals, and alloys) have been rising faster than imports of raw materials (such as raw textile materials and metal ores). A significant technological advance in chemicals and heavy industries and high energy costs of processing the raw materials were the principal factors for the change in the Japanese trade structure. In 1980, Japan's total exports were valued at $129.8 billion,[2] a 26% increase over that of 1979. Increased exports of automobiles and machinery and equipment contributed most to the increase in exports. Japan's total imports also rose by 27% to $140.5 billion. Increased imports of mineral fuels contributed most to the increase in imports, despite a decline in volume of crude oil imports in 1980. The merchandise trade deficit in 1980 was valued at $10.7 billion.

During 1978-80, Japan's export earnings and import expenditures of selected major mineral-related groups were summarized as follows, in million U.S. dollars:

	1978	1979	1980
Exports:			
Chemicals	5,102	6,100	6,766
Chemical fertilizers	282	328	376
Nonmetallic mineral products	1,378	1,547	1,862
Metal and metal products	16,041	18,378	21,318
Iron and steel	11,854	14,113	15,454
Imports:			
Chemicals	3,763	5,178	6,202
Metal, ore and scrap	4,836	6,850	8,429
Iron ore	2,453	2,999	3,448
Nonferrous metal ore	1,754	2,879	3,730
Mineral fuels	31,336	45,286	69,991
Petroleum, crude and partly refined	23,432	33,470	52,762
Petroleum products	2,273	4,499	5,087

In its report to the Ministerial Conference for Enforcing Comprehensive Energy Policies in 1980, MITI stressed that securing a steady supply of energy is the utmost priority for Japan. It was recommended that the Government should press ahead with policies designed to secure a steady supply of oil, to promote energy conservation pursuant to the Law for Rationalization of Energy Use, to push forward comprehensive measures for the development and introduction of nonoil energy sources (atomic power, coal, LNG, etc.), pursuant to the Alternative Energy Law, to deepen the understanding of the communities adjacent to proposed sites for power stations, to simplify the procedures for the development of sites for power stations, and to implement the laws concerning power source developments.

In 1980, MITI announced that it would seek an appropriation of 2.1 billion yen in FY 1981 for the research and development of a satellite and equipment program to launch a natural resources exploration project. MITI planned to launch the satellite into a 560-kilometer earth orbit to conduct exploration from space for oil, uranium, iron ore, and other natural resources in 1986. The estimated total project cost was about 80 billion yen.

PRODUCTION

Japan's mine production of copper, gold, lead, manganese, tin, and tungsten declined in 1980, while production of iron ore and most of the nonmetallic minerals including clays, dolomite, limestone, pyrophyllite, and silica stone and sand, were at a higher level in 1980 than in 1979. Domestic crude oil and natural gas production continued to decline in 1980. However, coal production in 1980 increased slightly over that of 1979 owing to an increase in labor productivity.

Production of metals through processing of domestically produced and imported raw materials in 1980 was at a higher level for aluminum, cobalt, copper, tin, and titanium reflecting either increased exports or strong domestic demand for the metals. Production of gold, iron and steel, lead, primary magnesium, nickel, silver, and zinc decreased slightly owing to the sluggish domestic demand and reduced exports. Japan became the world's second largest producer of steel in 1980. In metal output of aluminum, copper, and zinc, Japan remained among the world's top 10 producing countries. Japan's production of titanium sponge increased by 46% to 19,000 tons, surpassing the output of the United States and making Japan the world's second largest producer following the U.S.S.R. in 1980.

Production of cement by processing domestic raw materials reached another record high in 1980, while output of fertilizer continued to decline owing to increased prices of raw materials and declining exports. Japan remained a major producer of refined oil and petrochemicals in 1980.

Table 1.—Japan: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Alumina, gross weight, thousand tons	1,411	1,785	1,502	1,546	1,936
Metal:					
Primary:					
Regular grades, do.	919	1,188	r1,058	1,010	1,091
High-purity, do.	4	5	4	4	4
Secondary, do.	r527	r587	r660	768	792

See footnotes at end of table.

Table 1.—Japan: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Antimony:					
Oxide	5,901	5,571	[r]5,427	6,079	6,482
Metal	2,207	1,302	[r]1,017	512	355
Arsenic, white (equivalent of arsenic acid)	60	NA	NA	NA	NA
Bismuth	[r]682	698	[r]624	458	338
Cadmium	2,500	2,844	[r]2,531	2,597	2,173
Chromium:					
Chromite, gross weight	22,150	[r]17,881	[r]8,696	11,905	13,610
Metal	2,417	2,743	2,885	3,158	3,621
Cobalt metal	515	1,093	1,864	2,653	2,867
Columbium and tantalum: Tantalum metal	[r]42	[e]50	NA	NA	NA
Copper:					
Mine output, metal content	81,606	81,395	71,951	59,100	53,218
Metal:					
Blister and anode:					
Primary	769,400	848,400	854,500	853,700	861,000
Secondary	[r]68,800	[r]66,800	[r]51,400	67,700	68,800
Total	[r]838,200	[r]915,200	[r]905,900	921,400	929,800
Refined:					
Primary	[r]769,355	848,586	854,474	853,693	889,497
Secondary	[r]94,996	85,117	104,596	130,007	124,795
Total	864,351	933,703	959,070	983,700	1,014,292
Germanium:					
Oxide	22	16	[r]17	15	16
Metal	16	13	11	10	13
Gold:					
Mine output, metal content thousand troy ounces	138	149	145	128	102
Metal do	[r]1,044	[r]1,219	1,357	1,311	1,217
Indium metal do	[r]222	[r]231	[r]209	322	386
Iron and steel:					
Iron ore and iron sand concentrate:					
Gross weight thousand tons	758	[r]685	[r]595	460	478
Iron content do	450	400	361	284	[e]295
Roasted pyrite concentrate (50% or more Fe) do	653	571	487	432	366
Metal:					
Pig iron and blast-furnace ferroalloys do	86,576	85,886	78,589	83,826	87,041
Electric-furnace ferroalloys:					
Ferrochrome	463,541	398,782	274,421	365,490	402,997
Ferromanganese	632,160	527,418	455,729	603,019	569,147
Ferronickel	198,411	224,339	198,482	303,716	276,829
Ferrosilicon	313,077	291,446	270,052	319,553	303,754
Silicomanganese	373,196	333,692	303,249	299,680	310,714
Ferrochromium-silicon	11,046	11,411	[2]9,208	[2]12,623	[2]20,531
Other:					
Calcium silicon	3,898	5,634	1,896	3,349	3,859
Ferrocolumbium	1,608	1,281	1,193	1,207	1,159
Ferromolybdenum	4,501	3,705	3,904	3,406	4,367
Ferrotungsten	447	371	243	251	242
Ferrovanadium	3,901	2,546	3,193	4,628	3,526
Unspecified	2,061	7,352	9,637	9,298	10,360
Total	2,007,847	1,807,977	[3]1,531,207	[3]1,926,220	[3]1,907,485
Steel, crude thousand tons	107,399	102,405	102,105	111,748	111,395
Semimanufactures, hot-rolled:					
Of ordinary steels do	83,161	79,617	79,625	89,075	88,888
Of special steels do	9,885	10,304	11,669	12,522	12,872
Lead:					
Mine output, metal content	51,666	54,764	[r]56,489	46,929	44,765
Metal, refined:					
Primary	219,053	221,398	[r]228,442	221,247	220,934
Secondary	53,815	56,496	[r]53,537	53,376	74,277
Magnesium metal:					
Primary	11,190	9,416	[r]11,162	11,368	9,252
Secondary	[r]7,601	[r]7,584	[r]10,938	16,382	23,872
Manganese:					
Ore and concentrate:					
Gross weight	141,742	126,156	[r]104,147	87,929	79,579
Manganese content	38,696	32,801	28,640	23,213	21,009
Oxide	32,540	[r]27,429	31,131	36,110	39,487
Metal	6,752	7,267	6,463	4,029	4,431

See footnotes at end of table.

Table 1.—Japan: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Molybdenum:					
Metal content of concentrate	220	182	r123	117	94
Metal	336	275	309	409	388
Nickel metal:					
Refined	24,010	24,139	21,636	25,030	24,798
Ni content of ferronickel	70,790	69,761	57,564	75,970	74,300
Total	94,800	93,900	79,200	101,000	99,098
Platinum-group metals:					
Palladium metal troy ounces	18,089	22,716	r24,021	22,495	28,967
Platinum metal do	8,706	9,737	r10,176	12,142	12,366
Rare-earth metals:					
Lanthanum oxide	80	109	97	149	188
Cerium metal	301	NA	NA	NA	NA
Selenium, elemental	460	456	481	510	471
Silicon metal	283	289	259	337	476
Silver:					
Mine output, metal content thousand troy ounces	9,299	r9,604	r9,664	8,680	8,879
Metal, primary do	36,522	38,184	r38,783	39,104	37,828
Tellurium, elemental	30	65	69	56	69
Tin:					
Mine output, metal content	643	r605	r603	660	549
Metal, smelter	r1,129	1,280	r1,141	1,251	1,319
Titanium:					
Slag	3,486	1,228	175	180	NA
Metal	r6,391	6,395	r9,176	13,190	19,362
Tungsten:					
Mine output, metal content	r814	r772	r775	746	668
Metal	1,431	r1,549	r1,479	1,736	2,049
Uranium metal kilograms	3,043	e3,000	NA	NA	NA
Zinc:					
Mine output, metal content	259,953	275,731	274,629	243,354	238,128
Oxide	59,182	58,297	r56,785	61,514	63,497
Metal:					
Primary	742,069	778,406	767,949	789,352	735,189
Secondary	33,976	26,547	24,770	26,973	49,917
NONMETALS					
Asbestos	7,703	r6,307	r5,746	3,502	3,897
Barite	53,704	r58,213	r70,967	55,722	57,092
Bromine, elemental[e]	12,000	12,000	12,000	12,000	12,000
Cement, hydraulic thousand tons	68,712	73,138	r84,882	87,139	87,957
Clays:					
Bentonite[e]	400,000	400,000	400,000	400,000	400,000
Fire clay	890,926	902,263	r1,475,608	1,432,241	1,529,741
Kaolin	226,073	r226,329	227,134	218,137	228,205
Feldspar and related materials:					
Feldspar	41,217	42,403	42,119	37,548	33,389
Aplite	357,915	394,639	r377,548	394,240	410,583
Gypsum thousand tons	r5,063	r5,551	r5,794	6,273	e6,500
Iodine, elemental	6,954	6,100	6,000	6,250	6,501
Lime: Quicklime thousand tons	9,176	9,022	9,058	9,628	9,350
Nitrogen: N content of ammonia do	2,236	2,292	2,454	2,415	e2,330
Perlite	65,000	70,000	73,000	75,000	77,000
Salt, all types thousand tons	1,021	1,056	1,073	1,090	1,102
Sodium compounds, n.e.s.:					
Sodium carbonate	1,085,463	1,178,899	1,161,570	1,354,442	1,355,403
Sodium sulfate	313,073	324,030	r320,177	338,467	309,988
Stone, crushed and broken:					
Dolomite thousand tons	5,524	r5,764	6,087	6,119	6,361
Limestone do	147,530	r154,121	r172,543	182,781	184,726
Sulfur:					
S content of pyrite do	471	389	327	303	354
Byproduct:					
Of metallurgy do	1,252	1,336	1,296	1,350	1,300
Of petroleum do	r926	1,100	r1,105	1,241	1,173
Talc and related materials:					
Talc	104,836	127,616	r139,491	120,403	122,475
Pyrophyllite	1,692,105	1,671,386	r1,555,434	1,588,461	1,628,467
Vermiculite[e]	13,000	14,000	15,000	16,000	17,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black thousand tons	409	e425	489	538	575

See footnotes at end of table.

Table 1.—Japan: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coal:					
Anthracite ---------- thousand tons	38	[r]5	--	23	8
Bituminous coal[4] ---------- do	18,359	[r]18,246	18,992	17,643	18,027
Lignite ---------- do	53	[e]40	39	32	27
Total ---------- do	18,450	[r]18,291	19,031	17,698	18,062
Coke including breeze:					
Metallurgical ---------- do	43,446	[e]43,000	40,546	43,189	47,463
Metallurgical breeze ---------- do	2,181	[e]2,000	[e]2,000	2,000	NA
Gashouse including breeze ---------- do	4,131	[r]3,717	3,342	3,226	3,494
Fuel briquets, all grades ---------- do	466	[e]450	421	479	453
Gas, natural:					
Gross[5] ---------- million cubic feet	[r]88,047	[r]99,025	[r]93,255	85,250	77,593
Marketed ---------- do	[r]85,638	[r]96,281	[r]90,440	83,455	75,545
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	37	[e]37	[e]37	[e]37	NA
Liquefied petroleum gas from natural gas (field plants only) ---------- do	293	[e]300	[e]300	[e]300	NA
Peat[e] ---------- thousand tons	70	70	60	60	NA
Petroleum:					
Crude ---------- thousand 42-gallon barrels	4,241	4,334	3,963	3,522	3,169
Refinery products:					
Gasoline:					
Aviation ---------- do	198	157	170	138	88
Other ---------- do	189,530	196,317	209,449	215,910	214,614
Jet fuel ---------- do	22,102	24,077	26,074	26,669	28,839
Kerosine ---------- do	151,567	183,405	187,073	193,537	178,718
Distillate fuel oil ---------- do	230,939	114,870	122,975	135,652	135,633
Residual fuel oil ---------- do	674,246	803,850	780,226	779,628	697,507
Lubricants ---------- do	13,713	14,221	11,440	12,277	12,636
Other:					
Asphalt and bitumen ---------- do	24,972	28,103	31,219	30,618	28,411
Liquefied petroleum gas ---------- do	50,592	37,135	48,645	52,413	47,067
Naphtha ---------- do	180,897	126,796	120,057	118,563	110,512
Paraffin ---------- do	885	1,132	1,088	1,195	1,101
Petroleum coke ---------- do	1,143	1,730	440	503	692
Unfinished oils ---------- do	47,489	44,224	38,300	45,362	44,557
Refinery fuel and losses ---------- do	92,353	125,446	110,768	83,441	[6]110,411
Total ---------- do	1,680,626	1,701,463	1,687,924	1,695,906	1,610,786

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 8, 1981.

[2]For reasons not evident in sources, these figures are reported as negative numbers. (See also footnote 3.)

[3]Sum of listed detail as reported, but adding quantity bearing footnote 2 as positive numbers. Japanese sources provide the following totals for ferroalloy output in the years indicated: 1978, 1,512,791; 1979, 1,900,974; and1980, 1,866,423. These totals represent the sum of listed detail using the quantities bearing footnote 2 as negative numbers, thereby not only omitting the footnoted numbers, but actually subtracting them from the sum of all other alloys. The reason for this procedure in source publications is not explained.

[4]Includes a small amount of natural coke.

[5]Includes output from gas mines and coal mines.

[6]May include some additional unfinished oils.

TRADE

In 1980, Japan's total value of two-way merchandise trade reached $270.3 billion, with values of exports and imports amounting to $129.8 billion and $140.5 billion, respectively. The record high trade deficit of over $10 billion represented a 40.3% increase over that of 1979. The increased deficit in 1980 was primarily because of a 54.6% increase in the import bills of crude oil and a 23% increase in the prices of imported mineral ores and metals.

The top seven foreign exchange earners were export of motor vehicles, valued at $23.3 billion and accounting for 18% of the total export earnings; iron and steel, $15.5 billion (12%); vessels, $4.7 billion (3.6%); scientific and optical equipment, $4.5 billion (3.5%); metal products, $3.9 billion (3.0%); tape recorders, $3.3 billion (2.5%); and radio receivers, $3 billion (2.3%). The seven principal imports were petroleum (crude and partly refined), valued at $52.8 billion,

which accounted for 37.6% of the total imports; wood, $6.9 billion (4.9%); petroleum products, $5.1 billion (3,6%); nonferrous metals, $4.5 billion (3.2%); coal, $4.5 billion (3.2%); nonferrous metal ores, $3.7 billion (2.6%); and iron ore, $3.5 billion (2.5%).

Of Japan's total exports, the United States remained the principal customer for total exports, accounting for about 24%, followed by the Federal Republic of Germany, 4.4%; the Republic of Korea, 4.1%; Taiwan, 4.0%; China, 3.9%; Hong Kong, 3.7%; and Saudi Arabia, 3.7%. The United States was the main buyer of Japan's motor vehicles, iron and steel, metal products, machinery and equipment (other than motor vehicles), and nonmetallic mineral products.

The United States also remained the major supplier of total imports, accounting for about 17%, followed by Saudi Arabia, 14%; Indonesia, 9.4%; Australia, 5.0%; Canada, 3.4%; Iraq, 3.1%; and China, 3.1%. The United States was the main supplier of Japan's chemicals, coal, equipment and machinery, foodstuffs, metal ores and scrap, and wood.

During 1980, the top seven trading partners of Japan, based on the value of two-way trade, were the United States with total trade valued at $55.8 billion; Saudi Arabia, $24.4 billion; Indonesia, $16.6 billion; Australia, $10.4 billion; China, $9.4 billion; the Republic of Korea, $8.4 billion; and Taiwan, $7.4 billion.

Table 2.—Japan: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	1,821	1,000	--	All to Republic of Korea.
Oxides and hydroxides	175,065	259,583	1,270	Canada 76,249; Republic of Korea 65,463; U.S.S.R. 53,607.
Fused alumina (artificial corundum)	12,949	16,735	523	Republic of Korea 8,235; Taiwan 4,988.
Metal including alloys:				
Scrap	1,097	292	--	Republic of Korea 137; Taiwan 113.
Unwrought	54,594	7,946	1	Philippines 3,094; Republic of Korea 1,714.
Semimanufactures	149,185	98,959	39,025	Republic of Korea 11,082; Taiwan 6,699; Hong Kong 6,580.
Arsenic trioxide, pentoxide, acid	6	NA	NA	NA.
Beryllium metal including alloys, all forms kilograms	237	6	--	Singapore 5.
Bismuth metal including alloys, all forms	288	182	71	Netherlands 52.
Cadmium metal including alloys, all forms	111	151	--	Netherlands 94; United Kingdom 23; India 20.
Chromium:				
Chromite	1,636	1,786	--	All to Republic of Korea.
Oxides and hydroxides	1,562	1,965	612	Taiwan 616; Republic of Korea 370.
Cobalt oxides and hydroxides	87	41	2	Netherlands 8; West Germany 6; Taiwan 6.
Columbium and tantalum: Tantalum metal including alloys, all forms	41	30	16	West Germany 9; Austria 5.
Copper:				
Sulfate	325	246	--	Taiwan 177; Indonesia 20.
Metal including alloys:				
Waste and scrap	51,411	47,233	18,387	Taiwan 24,125.
Unwrought	4,530	5,535	650	Republic of Korea 4,792.
Semimanufactures	164,324	175,974	30,124	Hong Kong 28,700; Taiwan 24,898; Singapore 12,994.
Iron and steel:				
Ore and concentrate	18	49	--	Taiwan 35; Hong Kong 14.
Metal:				
Scrap	164,395	150,562	97	Republic of Korea 78,125; Hong Kong 46,646.
Pig iron, including cast iron	32,678	50,225	--	Republic of Korea 28,183; Bangladesh 16,500.
Sponge iron, powder, shot	10,585	10,537	1,341	Australia 2,337; Republic of Korea 2,047; Taiwan 1,193.
Ferroalloys:				
Ferromanganese thousand tons	37,147	92,886	30,927	China, mainland 23,290; Australia 10,294.
Other do	r33,153	39,559	5,885	Netherlands 23,097; China, mainland 4,002; Republic of Korea 2,132.
Steel, primary forms do	4,428	4,568	575	Republic of Korea 1,154; Taiwan 503; Philippines 289.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	6,166	7,202	1,351	China, mainland 1,379; Saudi Arabia 929; Iraq 568.
Universals, plates, sheets:				
Uncoated do	10,372	6,019	972	China, mainland 1,595; Taiwan 638; Republic of Korea 361.
Tinned do	815	834	189	China, mainland 104; Philippines 93; Singapore 56.
Other, coated do	2,315	2,381	1,092	Saudi Arabia 110.
Hoop and strip do	812	633	62	China, mainland 152; Indonesia 58; Taiwan 34.
Rails and accessories do	193	139	37	China, mainland 33.
Wire do	367	302	115	China, mainland 24.
Tubes, pipes, fittings do	6,280	6,630	1,375	U.S.S.R. 1,242; China, mainland 770.
Castings and forgings, rough do	31	26	14	Iraq 2; Taiwan 2.
Lead:				
Ore and concentrate	9,312	8,266	--	All to U.S.S.R.
Oxides	1,021	243	--	Taiwan 123; Burma 79.
Metal including alloys, all forms	9,587	15,627	2	Taiwan 6,602; Republic of Korea 5,596.
Magnesium metal including alloys, all forms	313	108	--	Republic of Korea 40; Taiwan 24; Singapore 17.
Manganese:				
Ore and concentrate	4,831	6,230	--	Republic of Korea 3,442; Indonesia 962.
Oxides	21,946	19,436	3,401	Republic of Korea 2,329; Indonesia 2,135; Philippines 1,570.
Mercury 76-pound flasks	6,929	15,662	9,273	Netherlands 1,261; Taiwan 1,200; Indonesia 1,082.
Molybdenum metal including alloys, all forms	39	71	18	Hungary 18.
Nickel:				
Ore and concentrate	--	40	--	All to Sweden.
Metal including alloys, all forms	5,242	2,623	1,232	Taiwan 205; Republic of Korea 162.
Phosphorus, elemental (red)	148	91	2	Taiwan 30; Vietnam 25; Philippines 15.
Platinum-group metals including alloys, unwrought and partly wrought thousand troy ounces	123	137	14	Taiwan 68; Netherlands 22; Republic of Korea 15.
Selenium, elemental	264	313	39	Netherlands 98; United Kingdom 71.
Silver:				
Waste and scrap	15	24	--	Mainly to Republic of Korea.
Metal including alloys, unwrought and partly wrought thousand troy ounces	3,015	4,155	883	Taiwan 942; Republic of Korea 813; United Kingdom 767.
Tin:				
Oxides	11	35	17	Netherlands 4; Republic of Korea 4.
Metal including alloys, all forms	r488	1,405	2	Burma 439; Taiwan 435; Mozambique 120.
Titanium:				
Oxides	10,503	13,818	2,875	Taiwan 3,916; Republic of Korea 2,554; China, mainland 1,202.
Metal including alloys, all forms	4,176	4,887	2,164	Netherlands 1,382; United Kingdom 1,055.
Tungsten metal including alloys, all forms	172	209	43	U.S.S.R. 58; Taiwan 25.
Zinc:				
Ore and concentrate	458	798	--	All to Canada.
Oxides	1,322	690	(2)	Republic of Korea 313; Thailand 123; Taiwan 108.
Metal including alloys, all forms	67,181	42,642	12,005	Republic of Korea 9,320; Taiwan 5,572; Thailand 4,071.
Other:				
Ores and concentrates:				
Of molybdenum, tantalum, titanium, vanadium, zirconium	1,398	844	29	Republic of Korea 632; Vietnam 100.
Of other base metals	153	2	--	Malaysia 1; People's Democratic Republic of Yemen 1.
Ash and residue containing nonferrous metals	5,123	10,898	3,314	Belgium 1,608; United Kingdom 1,531; West Germany 1,240.
Oxides, hydroxides, peroxides	2,164	1,592	156	Republic of Korea 457; Taiwan 276; Iraq 200.
Metals:				
Metalloids	149	NA	NA	NA.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Metals —Continued				
Alkali, alkaline earth, rare-earth metals	688	861	100	Taiwan 554; France 58.
Pyrophoric alloys	81	76	12	France 30; Hong Kong 9.
Base metals including alloys, all forms	7,236	5,841	2,004	West Germany 617; Australia 506; Netherlands 425.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Emery	1,429	1,340	--	Taiwan 400; Republic of Korea 304; Hong Kong 171.
Other	416	506	1	Taiwan 243; Republic of Korea 242.
Dust and powder of precious and semi-precious stones -- thousand carats	1,168	934	685	Taiwan 138; Republic of Korea 83.
Grinding and polishing wheels and stones	4,868	6,215	976	Thailand 784; Hong Kong 707; Singapore 677.
Asbestos	756	147	--	Taiwan 50; Republic of Korea 40; India 26.
Barite and witherite	2,894	1,002	--	U.S.S.R. 1,000.
Boron materials:				
Crude natural borates	285	381	--	All to Republic of Korea.
Oxide and acid	120	150	(2)	Republic of Korea 101; Taiwan 35.
Cement thousand tons	8,624	10,814	1,468	Saudi Arabia 2,594; Kuwait 1,965; Singapore 1,290.
Chalk	50	13	--	All to Republic of Korea.
Clays and clay products:				
Crude clays	64,171	79,267	20	Taiwan 50,865; Republic of Korea 14,372.
Products:				
Refractory including nonclay brick	167,655	196,270	8,580	Republic of Korea 47,164; Taiwan 20,804; Brazil 20,766.
Nonrefractory[3]	48,442	44,896	16,090	Singapore 10,514; Hong Kong 6,337.
Diamond:				
Gem, not set or strung carats	232	1,031	--	Republic of Korea 539; Hong Kong 484.
Industrial do	1,185	1,286	--	Romania 478; North Korea 225; Republic of Korea 219.
Diatomite and other infusorial earth	1,298	1,277	15	Taiwan 392; Cuba 192; U.S.S.R. 180.
Feldspar	15,157	23,630	6	Taiwan 22,219.
Fertilizer materials:				
Manufactured:				
Nitrogenous thousand tons	2,030	1,816	(2)	China, mainland 1,268.
Phosphatic	10,726	26,243	--	Burma 18,414; Taiwan 4,510.
Potassic	4,153	2,006	--	Republic of Korea 2,003.
Other including mixed	64,182	141,185	499	Thailand 88,546; Philippines 21,100.
Ammonia	201,108	169,675	--	Philippines 156,368.
Fluorspar, leucite, nepheline, nepheline syenite	532	115	--	Taiwan 71; Indonesia 36.
Graphite, natural	1,406	1,554	217	Republic of South Africa 650; Taiwan 412.
Gypsum and plasters	6,172	6,157	22	Taiwan 2,524; Republic of Korea 1,392; Indonesia 822.
Kyanite and related materials	16,470	22,721	--	Taiwan 16,362; Republic of Korea 2,816; Thailand 2,170.
Lime	33,290	28,581	--	Papua New Guinea 22,562.
Magnesium materials:				
Magnesite and magnesia clinker	144,796	133,832	24,676	Australia 22,815; Taiwan 13,670; Republic of Korea 12,488.
Oxides	NA	4,467	780	West Germany 1,019; Taiwan 511; U.S.S.R. 350.
Mica, all forms	783	714	39	Hong Kong 308; Taiwan 210.
Pigments, mineral including processed iron oxides	15,589	16,731	3,169	Taiwan 7,159; Mexico 1,250; Republic of Korea 1,080.
Precious and semiprecious stones except diamond:				
Natural kilograms	75,753	50,044	2,388	Republic of Korea 29,340; Taiwan 11,617.
Manufactured do	24,108	29,934	839	Republic of Korea 12,197; West Germany 6,830; Malaysia 3,297.
Salt and brine	2,934	2,774	1,850	North Korea 338; Papua New Guinea 174.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	146,385	243,413	15	Australia 192,962; Republic of Korea 27,179; Thailand 20,491.
Caustic potash, sodic and potassic peroxides	5,501	5,268	55	Taiwan 1,217; Australia 1,149; Republic of Korea 1,025.

See footnotes at end of table.

Table 2.—Japan: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s. — Continued				
Soda ash	110,487	114,598	13	Indonesia 43,371; Philippines 22,958; Republic of Korea 13,357.
Stone, sand and gravel:				
Dimension stone	1,507	1,010	50	Republic of Korea 417; Saudi Arabia 194.
Dolomite, chiefly refractory-grade	5,399	8,470	--	Philippines 5,350; Indonesia 2,060.
Gravel and crushed rock	19,541	213,617	14	Australia 138,520; Republic of Korea 73,834.
Limestone except dimension thousand tons	1,339	1,427	(2)	Australia 1,280.
Quartz and quartzite	568	1,209	43	Saudi Arabia 350; Taiwan 336; Republic of Korea 232.
Sand excluding metal-bearing	6,956	4,667	--	United Arab Emirates 1,020; Taiwan 959; Republic of Korea 778.
Sulfur:				
Elemental:				
Other than colloidal	320,986	414,884	--	Republic of Korea 312,762; Taiwan 86,609.
Colloidal	220	221	--	North Korea 132; Cuba 40; Iraq 32.
Sulfur dioxide	66	[4]33	--	Taiwan 31.
Sulfuric acid	325,195	362,387	--	Turkey 140,312; Peru 87,039; Philippines 75,745.
Talc, steatite, soapstone	1,803	1,145	--	Taiwan 352; Republic of Korea 235; Philippines 176.
Other:				
Crude	10,112	12,335	19	Republic of Korea 4,991; Taiwan 2,669; Argentina 766.
Slag, dross, and similar waste, not metal-bearing	[r]517,185	528,972	--	Republic of Korea 237,571; Philippines 156,051.
Oxides, hydroxides, peroxides of strontium and barium	[5]4,340	27,019	253	Poland 18,254; Thailand 2,561; Republic of South Africa 2,000.
Bromine, iodine, fluorine	6,020	5,524	2,217	United Kingdom 734; France 650; West Germany 609.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	7	3	--	Republic of Korea 2.
Carbon black and gas carbon:				
Carbon black	30,856	26,883	16	China, mainland 14,076; Indonesia 2,625; Singapore 1,461.
Gas carbon	26	--		
Coal, all grades, including briquets	47,740	59,563	--	Republic of Korea 40,862; North Korea 15,400.
Coke and semicoke	896	2,081	1,012	Philippines 222; Peru 149; Republic of Korea 138.
Hydrogen, helium, rare gases	1,156	1,008	11	Taiwan 351; Republic of Korea 155; Saudi Arabia 127.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	83	62	--	Taiwan 51.
Kerosine do.	1,508	56	40	Australia 7.
Distillate fuel oil do.	503	(2)	--	NA.
Residual fuel oil do.	233	452	50	Taiwan 203; Republic of Korea 198.
Lubricants do.	2,350	1,889	150	Republic of Korea 740; Taiwan 297; Indonesia 255.
Other:				
Liquefied petroleum gas do.	282	367	--	Republic of Korea 143; Philippines 140; Hong Kong 63.
Mineral jelly and wax do.	565	554	17	Republic of South Africa 148; Republic of Korea 93; India 52.
Petroleum coke do.	33	37	--	Italy 31.
Bitumen do.	6	7	--	NA.
Unspecified do.	101	101	--	Republic of Korea 50; Taiwan 19; India 16.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	149,461	163,991	8,733	U.S.S.R. 78,900; Republic of Korea 38,189; Taiwan 23,205.

[r]Revised. NA Not available.

[1]Excludes exports under the Japanese-United States Mutual Defense Agreement or for account of the U.S. military forces.

[2]Less than 1/2 unit.

[3]Excludes mosaic tiles valued at $83,370,000 in 1978 and $82,918,000 in 1979.

[4]May contain some arsenic trioxide and pentoxide.

[5]Includes oxides of magnesium.

Table 3.—Japan: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate thousand tons	4,743	4,597	2	Australia 3,204; Indonesia 1,012.
Oxide and hydroxide do	759	761	2	Australia 741.
Fused alumina (artificial corundum)	5,769	10,875	259	India 4,717; Brazil 4,464.
Metal including alloys:				
Scrap	139,612	181,531	143,705	Canada 11,560.
Unwrought	740,204	748,438	104,270	New Zealand 110,132; Canada 108,811.
Semimanufactures	25,889	33,055	5,815	Romania 10,856; France 3,494; Venezuela 1,904.
Antimony:				
Ore and concentrate	6,553	6,702	56	Bolivia 5,603; Republic of South Africa 536; Thailand 335.
Metal including alloys, all forms	1,611	3,202	--	China, mainland 2,895; Bolivia 83; Spain 69.
Arsenic:				
Natural sulfides	10	30	--	All from China, mainland.
Trioxide, pentoxide, acids	755	999	--	France 666; Mexico 180.
Beryllium:				
Oxides	33	75	75	
Metal including alloys, all forms kilograms	1,674	2,197	2,197	
Chromium:				
Ore and concentrate	669,987	962,251	--	[e] Republic of South Africa 443,340; Philippines 183,553; India 156,133.
Oxide and hydroxide	3,505	2,977	1,191	West Germany 987; U.S.S.R. 650.
Cobalt:				
Oxide and hydroxide	615	651	23	Belgium 582; Canada 31.
Metal including alloys, all forms	1,351	197	75	United Kingdom 56; Netherlands 31; Canada 25.
Columbium and tantalum:				
Columbium (niobium) ore and concentrate	1,858	1,659	--	Canada 883; Brazil 600.
Tantalum:				
Ore and concentrate	128	304	--	Malaysia 142; West Germany 75.
Metal including alloys, all forms	46	61	54	West Germany 5.
Copper:				
Ore and concentrate thousand tons	2,818	2,969	172	Philippines 888; Canada 776; Papua-New Guinea 379.
Sulfate	553	730	(2)	China, mainland 215; Taiwan 154; Peru 120.
Metal including alloys:				
Scrap	55,049	50,158	24,556	Hong Kong 11,100; Taiwan 8,479.
Unwrought	[r]333,073	395,062	8,716	Zambia 158,889; Chile 78,040.
Semimanufactures	1,359	3,295	1,701	West Germany 447; Belgium 270.
Germanium:				
Dioxide	12	15	(2)	West Germany 10; Belgium 3.
Metal including alloys, all forms kilograms	1	9	--	All from Belgium.
Gold metal including alloys, unwrought and partly wrought thousand troy ounces	3,167	2,022	12	Switzerland 880; United Kingdom 871.
Indium metal including alloys, all forms kilograms	[r]2,868	6,572	1,631	Canada 1,980; United Kingdom 693; Peru 558.
Iron and steel:				
Ore and concentrate except roasted pyrite thousand tons	114,645	130,268	--	Australia 55,297; Brazil 26,136; India 17,088.
Roasted pyrite	2,891	1,495	--	[e] All from Philippines.
Metal:				
Scrap thousand tons	3,229	3,346	2,727	Australia 314.
Pig iron including cast iron do	640	551	1	Australia 171; Brazil 149; Mexico 76.
Sponge iron, powder, shot	6,389	13,054	141	Sweden 7,794; Indonesia 4,117.
Ferroalloys	361,189	503,796	7,246	Republic of South Africa 251,577; Brazil 45,874; Norway 39,567.
Steel, primary forms	149,397	648,629	3,626	Taiwan 166,137; Republic of Korea 147,844; Sweden 103,159.
Semimanufactures	23,590	37,203	4,517	Republic of Korea 19,893; Italy 3,080; Sweden 2,600.
Lead:				
Ore and concentrate	222,447	218,544	--	Canada 143,680; Peru 44,233; Australia 14,703.
Oxides	766	1,492	86	Mexico 881; China, mainland 424; Bulgaria 100.

See footnotes at end of table.

Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Lead —Continued				
Metal including alloys:				
Scrap	6,704	2,023	1,224	New Zealand 215; Bahrain 134.
Unwrought	59,341	62,672	168	Mexico 12,823; Peru 12,606; North Korea 10,905.
Semimanufactures	17	31	28	West Germany 1.
Lithium:				
Elemental	20	20	20	
Oxides	479	780	544	U.S.S.R. 225.
Magnesium metal including alloys, all forms	r9,123	12,230	8,653	Norway 1,777; Canada 1,469.
Manganese:				
Ore and concentrate thousand tons	2,012	2,692	--	Republic of South Africa 1,180; Australia 550.
Oxides	40	216	6	Belgium 180; China, mainland 30.
Mercury 76-pound flasks	3,066	3,143	1	Algeria 2,391; Spain 600.
Molybdenum:				
Ore and concentrate	16,645	18,431	9,928	Canada 3,680; Chile 3,208.
Trioxide	497	613	612	NA.
Metal including alloys, all forms	110	73	45	West Germany 24.
Nickel:				
Ore and concentrate thousand tons	2,999	4,015	--	New Caledonia 2,128; Indonesia 1,128.
Matte, speiss, similar materials	29,748	42,041	--	Australia 23,878; Indonesia 10,110.
Metal including alloys:				
Scrap	3,522	1,948	892	Taiwan 457; United Kingdom 405.
Unwrought	10,890	19,719	1,404	Canada 4,922; U.S.S.R. 3,625; Australia 2,847.
Semimanufactures	r2,624	3,291	1,577	United Kingdom 1,194; Australia 209.
Platinum-group metals:				
Waste and sweepings value	$292,379	$722,603	--	Taiwan $566,784; West Germany $112,547.
Metals, unwrought and partly wrought:				
Platinum thousand troy ounces	1,231	980	102	Republic of South Africa 440; U.S.S.R. 267.
Palladium troy ounces	r739,644	967,254	81,566	U.S.S.R. 723,712; Republic of South Africa 81,277.
Rhodium do	27,801	38,677	3,504	U.S.S.R. 18,133; Republic of South Africa 8,874; United Kingdom 6,655.
Iridium, osmium, ruthenium do	19,731	30,479	6,173	United Kingdom 12,474; Republic of South Africa 11,542.
Alloys do	42,553	37,777	3,312	West Germany 23,759; Switzerland 7,620.
Rare-earth metals:				
Oxides and crude chlorides	1,588	2,652	286	China, mainland 1,037; India 760; France 268.
Metals (yttrium, scandium, intermixtures)	53	86	4	Brazil 66; Austria 11.
Selenium, elemental kilograms	--	726	--	All from Canada.
Silicon elemental	52,992	58,191	5,782	Spain 10,833; Republic of South Africa 8,337; France 7,510.
Silver:				
Ore and concentrate	4,109	4,113	--	Republic of Korea 2,300; Bolivia 1,813.
Waste and sweepings value	$171,103	$158,096	--	All from Singapore.
Metal including alloys, unwrought and partly wrought thousand troy ounces	r17,213	23,523	984	Peru 9,155; Mexico 8,821; Republic of Korea 1,784.
Tellurium kilograms	8	14,681	1,479	U.S.S.R. 9,980; Peru 2,722.
Tin:				
Oxide	4	5	--	Australia 4; United Kingdom 1.
Metal including alloys, all forms	28,769	30,555	3	Malaysia 17,696; Indonesia 6,423; Thailand 5,992.
Titanium:				
Ore and concentrate	399,131	420,433	--	Malaysia 187,165; India 83,492; Australia 71,109.
Slag	61,942	75,864	--	Canada 52,718; Republic of South Africa 23,146.
Oxide	3,279	3,939	353	West Germany 1,134; United Kingdom 1,130; China, mainland 559.
Tungsten:				
Ore and concentrate	2,264	3,133	380	Republic of Korea 815; Canada 486; Peru 386; Australia 284.
Metal including alloys, all forms	109	134	7	Republic of Korea 112.

See footnotes at end of table.

Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Uranium and thorium:				
Ores and concentrates	100	30	--	All from Australia.
Oxides (composed of uranium and thorium depleted in U-235) kilograms	262	565	--	India 350; United Kingdom 200.
Vanadium pentoxide	2,656	4,633	205	Republic of South Africa 4,073.
Zinc:				
Ore and concentrate	936,586	959,229	--	Canada 358,601; Australia 254,886; Peru 250,156.
Oxide	2,877	4,317	25	Republic of Korea 1,407; Taiwan 866; Singapore 825.
Metal including alloys, all forms	34,011	41,027	105	North Korea 29,224; Republic of Korea 4,129; Peru 3,789.
Zirconium ore and concentrate including zircon sand	89,729	161,505	--	Australia 145,712; Republic of South Africa 15,723.
Other:				
Ores and concentrates	40	128	--	Malaysia 98; Zaire 30.
Ash and residue containing nonferrous metals	45,144	64,033	15,437	India 13,944; Philippines 11,911; Australia 9,020.
Oxides, hydroxides, pentoxides	r1,510	1,651	517	Norway 345; Bolivia 185; Canada 184.
Metals:				
Metalloids	17,700	12,505	4,311	Canada 4,843; U.S.S.R. 2,002.
Alkali and alkaline-earth metals	59	97	62	U.S.S.R. 30.
Pyrophoric alloys	13	15	4	Austria 9.
Base metals including alloys, all forms	2,613	457	91	Republic of South Africa 306.
NONMETALS				
Abrasives, n.e.s.:				
Natural, crude	3,525	4,571	1,500	India 2,587.
Dust and powder of precious and semiprecious stones kilograms	16,726	37,495	--	West Germany 35,370; Australia 2,025.
Grinding and polishing wheels and stones	196	169	63	Italy 35; West Germany 26; Austria 15.
Asbestos, crude	234,901	291,531	14,029	Canada 125,552; Republic of South Africa 104,095; U.S.S.R. 28,524.
Barium materials:				
Barite and witherite	21,278	24,565	14	China, mainland 20,014; Thailand 4,522.
Oxides and hydroxides	147	292	--	Italy 234.
Boron materials:				
Crude, natural borates	56,782	67,378	235	Turkey 63,950; U.S.S.R. 3,193.
Oxide and acid	19,231	20,330	16,701	U.S.S.R. 2,137.
Cement	1,528	2,128	2,004	West Germany 117.
Clays and clay products:				
Crude clays:				
Kaolin	467,410	578,548	463,946	Republic of Korea 70,560; North Korea 26,400.
Kyanite, andalusite, sillimanite	22,987	22,801	7,438	Republic of South Africa 13,040; India 1,763.
Other	218,781	300,509	105,828	China, mainland 101,289; Republic of South Africa 60,135.
Products:				
Refractory including nonclay brick	5,913	7,988	1,211	Sweden 4,492; West Germany 871.
Nonrefractory	27,331	22,520	631	Italy 9,998; Republic of Korea 4,880.
Cryolite and chiolite	244	279	--	Denmark 143; Greenland 136.
Diamond:				
Gem, not set or strung thousand carats	808	732	45	India 245; Israel 232.
Industrial do.	697	624	142	Republic of South Africa 133; United Kingdom 79; Zaire 78.
Powder and dust do.	15,126	18,633	10,291	Ireland 7,379.
Diatomite and other infusorial earth	5,871	5,962	5,922	China, mainland 20; Mexico 20.
Feldspar, leucite, nepheline, nepheline syenite	9,064	5,269	36	China, mainland 3,059; India 1,177.
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrate)	2,000	3,000	--	All from Chile.
Phosphatic thousand tons	2,599	2,828	1,723	Morocco 673; Jordan 233.
Manufactured:				
Nitrogenous	26,143	24,349	1,204	Chile 17,999.
Phosphatic	86,037	76,814	47,016	Republic of Korea 29,108.
Potassic thousand tons	r1,322	1,342	145	Canada 686; U.S.S.R. 190.
Other including mixed	176,268	211,427	177,053	Republic of Korea 32,646.
Ammonia	4	32	32	

See footnotes at end of table.

Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fluorspar	371,387	467,135	--	China, mainland 205,489; Thailand 130,235; Republic of South Africa 117,509.
Graphite, natural	48,895	70,955	538	Republic of Korea 24,850; North Korea 22,456; China, mainland 11,267.
Gypsum and plasters	15,335	29,796	475	Morocco 29,200.
Magnesium materials:				
Magnesite and magnesia clinker	71,084	121,511	--	North Korea 79,474; China, mainland 37,897.
Oxides	NA	627	341	West Germany 121; France 106.
Mica, all forms	8,598	8,209	113	India 4,620; Canada 931; Madagascar 768.
Pigments, mineral including processed iron oxides	3,876	6,182	1,018	West Germany 2,888; China, mainland 1,585; Austria 594.
Precious and semiprecious stones except diamond:				
Natural	r678	645	31	Brazil 292; Mexico 161; Republic of South Africa 52.
Manufactured	22	35	21	West Germany 8.
Pyrite, gross weight	30,000	7,300	--	Mainly from Philippines.
Salt thousand tons	6,436	6,818	172	Mexico 6,406; Australia 3,267.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	r43,250	49,009	32,527	Taiwan 16,273.
Caustic potash and sodic and potassic peroxides	73	106	96	West Germany 10.
Soda ash	565	561	--	East Germany 381; Romania 120; U.S.S.R. 50.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	464,870	577,604	48,061	India 142,378; Republic of Korea 132,510; Republic of South Africa 75,704.
Worked	64,550	83,028	81	Republic of Korea 46,476; Italy 13,946; Taiwan 12,620.
Dolomite including agglomerated	166,160	247,202	2,355	Republic of Korea 153,096; Taiwan 90,728.
Gravel and crushed rock	188,255	236,790	--	Taiwan 212,367; France 11,663.
Limestone except dimension	1,301	787	--	Mainly from France.
Quartz and quartzite	78,874	100,177	355	Republic of Korea 35,382; Thailand 23,308; China, mainland 21,662.
Sand excluding metal-bearing	558,801	693,410	536	Australia 483,726; Taiwan 130,050.
Sulfur:				
Elemental, colloidal	563	582	574	West Germany 7.
Sulfuric acid kilograms	72	50	26	West Germany 24.
Talc, steatite, soapstone, pyrophyllite	447,718	550,265	33,124	China, mainland 314,869; Australia 93,707; Republic of Korea 55,206.
Other:				
Crude:				
Meerschaum, amber, jet	81	31	--	Mainly from Spain.
Unspecified	280,249	320,350	5,017	Republic of Korea 212,093; Australia 34,108.
Slag, dross, and similar waste, including kelp, not metal-bearing	204,592	171,699	--	Republic of Korea 75,597; Australia 50,660; India 36,520.
Oxides, hydroxides, peroxides of magnesium, strontium, barium	3444	53	42	West Germany 11.
Bromine and iodine	1,079	1,543	--	All from Israel.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4,074	4,281	3,926	Trinidad and Tobago 350.
Carbon black	7,923	9,966	6,372	Mexico 1,108; U.S.S.R. 796; Canada 768.
Coal including briquets:				
Anthracite thousand tons	1,052	1,028	8	China, mainland 402; Vietnam 319; Republic of South Africa 131.
Bituminous coal:				
Heavy coking, less than 8% ash do	13,067	16,242	8,734	Australia 4,937; U.S.S.R. 944; Canada 819.
Heavy coking, more than 8% ash do	25,856	26,918	2,105	Australia 14,003; Canada 9,573.
Other coking coal do	r12,202	14,366	2,673	Australia 8,099; Republic of South Africa 2,206; U.S.S.R. 735.
Lignite do	r38	42	1	Australia 33; U.S.S.R. 8.

See footnotes at end of table.

Table 3.—Japan: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke and semicoke thousand tons	62	11	--	Mainly from Australia.
Hydrogen, helium, rare gases	164	201	198	France 2.
Peat including briquets and litter	7,016	7,815	--	Canada 7,621.
Petroleum and refinery products:				
Crude and partly refined:				
Crude thousand 42-gallon barrels	1,646,045	1,718,622	--	Saudi Arabia 576,860; Indonesia 251,196; United Arab Emirates 180,186.
Partly refined do	r27,312	22,379	--	Kuwait 9,270; Saudi Arabia 7,113; Indonesia 3,931.
Refinery products:				
Gasoline do	64,611	65,027	320	Singapore 21,805; Kuwait 16,296; Saudi Arabia 8,930.
Kerosine and jet fuel do	r2,448	4,587	438	Singapore 3,461.
Distillate fuel oil do	r29,098	29,962	34	Saudi Arabia 26,358.
Residual fuel oil do	r75,702	89,343	401	Indonesia 22,797; Singapore 16,960; Iran 12,144.
Lubricants do	r740	871	475	Singapore 229; Netherlands Antilles 157.
Other:				
Liquefied petroleum gas do	r223,159	223,101	10,786	Brunei 61,071; Saudi Arabia 50,579; Indonesia 43,769.
Mineral jelly and wax do	82	155	58	Singapore 79.
Paraffin liquid do	r89	76	75	NA.
Petroleum coke do	10,053	12,464	10,311	China, mainland 1,362.
Bitumen and other residue do	162	1,425	1,421	NA.
Unspecified do	r55	95	91	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r144,529	199,648	45,816	Republic of Korea 106,059; China, mainland 39,807.

rRevised. NA Not available.
[1]Excludes imports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces.
[2]Less than 1/2 unit.
[3]Includes oxides of magnesium.

COMMODITY REVIEW

METALS

Aluminum.—After a quick recovery sustained by reduced output and increased demand in 1979, Japan's ailing aluminum industry suffered again in 1980 from a sharp fall in aluminum prices on the world market, a weak domestic demand for aluminum, and a continuing high cost of production. As a result, the imports of low-priced aluminum increased by 21% to an alltime high of 841,372 tons in 1980 and the aluminum stocks at producers plants rose from the 89,619-ton level at the end of 1979 to 231,491 tons at the end of 1980. Aluminum production was cut back substantially in the second half of 1980. For 1980 as a whole, Japan's aluminum smelting industry utilized its 1.64-million-ton-per-year capacity at only about a 67% rate.

Imports of aluminum ingots (including high and regular grades) and alloyed ingots in 1980 were mainly from the United States (34%), Venezuela (14%), and Canada (13%). Foreign aluminum was lower in price largely owing to a soft world market condition, significantly lower cost of production, and considerable appreciation of the Japanese yen. These factors were cited by an official at the MITI as the main contributing factors to the substantial increase of imports of aluminum ingots in 1980.

Japan's domestic demand for primary aluminum metal fell from 1.80 million tons in 1979 to 1.64 million tons in 1980. A drop in new housing starts and construction work reduced demand for aluminum sashes and related housing materials. An unusual-

ly cold summer and the general business slump adversely reduced sales of air-conditioners and beverage cans, which use aluminum sheets and plates. An overbooking of aluminum materials by consumers in anticipation of higher prices and metal shortages during 1979 was another main factor contributing to the downturn of the domestic demand for aluminum.

The long-term problem of high energy cost had forced the world's second largest aluminum smelting industry to scrap or freeze about 33% of its capacity in 1980. It was expected that more of the old and inefficient potlines would have to be shut down during the next few years. Based on the industry's estimate, the total production cost of Japan's aluminum was about $1.08 per pound, of which power costs alone averaged 50 to 57 cents per pound of aluminum, compared with about 15 cents per pound in the United States.[3] In an effort to reduce the high energy cost of aluminum production in Japan (about 72% of Japan's smelting capacity uses oil-fired generated electricity), the industry had either shut down uneconomical facilities or planned to convert to energy sources other than oil. Nippon Light Metal Co., Ltd., had closed its Niigata plant, which suffered a $23 million loss annually because of the high cost of oil-generated electricity. The company also planned to convert the oil-fired powerplant to coal at its Tomakomai plant in Hokkaido. Sumitomo Aluminum Smelting Co., Ltd., suspended part of its uneconomical smelting units at its Toyama plant and planned to build a 180-megawatt coal-fired powerplant to replace the existing oil-fired powerplant for its smelter at Kikumoto. Mitsui Aluminum Co., Ltd., had converted the powerplant at its Omata plant to coal. Other smelters were trying to develop energy-saving smelting technology and ways of utilizing wasted heat from the smelting and fabrication processes. The president of Japan's Light Metal Association indicated that Japan's aluminum industry must go to nuclear power to survive.

In past years, Japan's aluminum smelters were actively engaged in various overseas joint venture aluminum smelting operations. In addition to the joint venture projects already in operation in Venezuela and New Zealand, the Asahan aluminum project, a joint venture with Indonesia, was moving on schedule in North Sumatra (see Aluminum section of the Mineral Industry of Indonesia, 1980).

An agreement was finally reached in November 1980 between Japanese and Brazilian interests on the Amazon aluminum project. The entire $1,839 million (at 1979 prices) complex project, which includes a $1,278 million project for the Albras smelter and a $561 million project for the Alunorte alumina plant, would be funded 30% by equity capital and 70% by borrowing. On the equity portion, 51% would be owned by Rio Doce, the Brazilian state development and mining firm, and 49% by Nippon Amazon Aluminum Co., which is formed by the Japanese Overseas Economic Cooperation Fund and 31 Japanese companies (including 5 major smelters, 10 trading houses, and 16 users).

The construction work on the smelter at Bancarena near Belem was expected to begin in mid-1981. Upon completion of phase 1 by June 1984, the smelter would have two 80,000-ton-per-year potlines. By May 1985, another 160,000 tons per year of capacity would be added. The construction work for the 800,000-ton-per-year Alunorte alumina plant was scheduled to be completed by October 1984, and reach full capacity by February 1985 to provide feed for the smelter. Bauxite for the alumina plant, to be supplied by Rio Doce, would be mined in the Trombetas area along the Amazon. According to the agreement, the Japanese group would take 80% to 85% of Albras aluminum output in 1984-88, and 49% after that; the price of the aluminum would be based partly on Alcan's international price and partly on the Japanese imported price.

An agreement was reached in August 1980 between Nippon Light Metal Co., Ltd., and the Republic of South Africa's Alusuf Pty., Ltd., for the purchase of Nippon's used aluminum refining equipment from its Niigata plant at a cost between 1 billion to 1.5 billion yen. The shipment of the equipment to the Republic of South Africa was to start in late 1980.

Nippon Light Metal Co. was to resume high-purity metal production in October 1980 at an annual rate of 1,200 tons (the plant was shut down in May 1978). Sumitoma Aluminum Smelting Co. had increased its Kikumoto plant's capacity by 650 tons per year to 5,200 tons per year in 1980 owing to increased demand for super-purity aluminum for high-tension electrolytic condensers in Japan.

Copper.—Production of refined copper reached an alltime high of over 1 million tons in 1980; however, domestic copper ore production continued to decline. Domestic

copper ore supplied only 5% of refined copper production; imported ore and concentrate, 83%; and scrap and others, 12%. Japan's copper mine production was principally from copper-lead-zinc mine operations at Hanaka, Kosaka, Syakanai, and Minami-Furutobe in Akita Prefecture; copper-zinc operations at Shimokawa in Hokkaido; and copper-iron operations at Kamaishi in Iwate Prefecture. During 1980, Japan imported over 3.1 million tons of copper ore and concentrate. Principal suppliers were the Philippines, Canada, the United States, Papua New Guinea, Chile, Indonesia, Australia, Sabah (Malaysia), and Zaire.

Based on a MITI survey, copper smelting and refining capacities by company were as follows in tons.[4]

Company	Location	Annual capacity	
		Smelting	Refining
Nippon Mining Co., Ltd	Hitachi	84,000	192,000
	Saganoseki	240,000	168,000
Mitsubishi Metal Corp	Naoshima	168,000	163,200
Sumitomo Metal Mining Co., Ltd	Toyo	168,000	48,000
	Niihama	--	132,000
Mitsui Mining & Smelting Co., Ltd	Hibi	68,400	--
	Takehara	--	87,600
Dowa Mining Co., Ltd	Kosaka	63,360	48,000
	Okayama	--	12,000
Furukawa Mining Co., Ltd	Ashio	42,000	--
Furukawa Electric Co., Ltd	Nikko	--	48,000
Rasa Industries Co., Ltd	Miyako	31,200	--
Onahama S & R Co., Ltd	Onahama	234,000	234,000
Hibi Kyodo Smelting Co., Ltd	Tamano	132,000	102,000
Total		1,230,960	1,234,800

During 1980, Japan's copper smelting and refining industry was operating at 82% of total capacity.

Japan also imported 227,660 tons of refined copper in 1980; the principal suppliers were Zambia, Chile, Peru, and Zaire.

Japan's consumption of refined copper amounted to about 1,325,500 tons in 1980 compared with 1,330,100 tons in 1979. About 864,000 tons was for the manufacture of wire and cable, and 462,000 tons was for rolling mills and others. Consumption of rolled copper products (including copper and copper alloys, such as brass and bronze) by industry was as follows in tons:

Industry	1977	1979
Textile	254	368
Chemicals and allied products	2,904	2,075
Fabricated metal products	113,057	135,179
Electric machinery, equipment and supplies	171,843	225,281
Transportation equipment	84,181	100,009
Other machinery and equipment	76,834	104,383
Ordnance and accessories	1,198	2,997
Other manufacturing	102,848	97,257
Construction	31,657	44,705
Other	9,206	30,475
Total	593,982	742,729

Japan's exports of refined copper during 1980 was 205,728 tons compared with 46,934 tons in 1979. The major buyers of Japanese refined copper for 1980 were the United States (63%), Taiwan (24%), and China (6%). As a result of strong domestic demand for copper and an export boom in 1980, refined copper stocks at producer plants fell 63% to 53,851 tons at the end of 1980 from 143,973 tons at the end of 1979.

A 7-year contract between The Anaconda Copper Company of the United States and Nippon Mining Co., Ltd., and C. Itoh & Co., Ltd., was signed on December 17, 1980, in Tokyo. The contract calls for Anaconda to supply Nippon Mining, Mitsui Mining and Smelting, Mitsubishi Metal, Sumitomo Metal Mining, Furukawa, Dowa Mining, and Nittetsue Mining with copper ore for processing from Anaconda's mines in Arizona, Montana, and Utah. During 1981-82, the Japanese copper producers would receive 398,000 tons of copper concentrate (averaging 25% copper) annually, and 500,000 tons annually from 1983 through 1987. The contract can be automatically extended for 1 year without advance notice. It was reported that under the contract the Japanese smelters would be allowed to buy copper for their own needs (at least 50% of the refined copper would be bought by the Japanese smelters), and that it would take at least 5 months for the remaining toll-refined copper to be returned to the United States.

The contracted toll refining reportedly would allow Anaconda to remain competitive on a worldwide basis. It was estimated that it costs 45 cents per pound for Anaconda to smelt and refine in the United States, while the cost of smelting and refining in Japan was in the 33- to 35-cents-per-pound range.[5]

A Japanese-Chinese joint venture project for exploration and development of the copper mine at Anquin (Anjing) near Tongling in Anhui Province, China, was expected to start in the spring of 1981. The exploration was expected to take 3 to 4 years to be followed by the development of the copper mine. The Anquin Mine was estimated by the Chinese to have a deposit of 18 million tons of ore with an average copper content of 1.8%. The estimated costs for the exploration were between $4.8 million to $9.5 million. Japan plans to provide funds, technology and exploration equipment. In exchange, China is to provide the labor force and materials.

An agreement between Mitsubishi Corp. and Kennecott Corp. of the United States was expected to be signed by March 1981. Under the agreement, Mitsubishi was to invest about $116 million for a multiyear modernization program, and receive a one-third ownership of Kennecott's Chino Mines Div. (a copper mining and processing facility) near Silver City, N. Mex. Mitsubishi was to have the right to take one-third of the production.

Iron and Steel.—Japan displaced the United States as the world's second largest iron and steel producer in 1980. Output of pig iron was at a higher level, while the production of crude steel remained at about the same level as that of 1979. However, exports of steel dropped slightly in 1980 from that of 1979. Domestic apparent consumption of steel in 1980 increased slightly from that of 1979.

Japan's output of pig iron in 1980 accounted for about 15% of the world's production. Production of pig iron by blast furnace accounted for 99.8% in 1980. By the end of 1980, out of the country's 65 blast furnaces (excluding blown-out blast furnaces), 44 were in operation, and about 50% of the blast furnaces had adopted all-coke operations.

A downturn in demand from Japan's auto industry, the continued slump of the construction industry, and the decline in exports were the factors that caused a rapid decline of crude steel production in the second half of 1980. Production by basic oxygen furnaces (BOF) accounted for 75.5% of crude steel in 1980, and the remaining output was by electric furnaces. Crude steel production in 1980 was comprised of 94.5 million tons of ordinary steel and 16.9 million tons of special steel. Crude steel processed by continuous casting in 1980 was 66.3 million tons (a 59.5% overall continuous casting ratio of ordinary and special steel rollings compared with 52.0% in 1979). Continuous casting ratios for ordinary steel and special steel in 1980 were 63.3% and 38.3%, respectively. As a result of higher continuous casting ratios for 1980, the ratio of semifinished steel products to crude steel increased to over 90% compared with the ratio of about 70% to 80% for the United States and Europe. Japan ranks first in the world in both number of BOF's and continuous-casting machines. By the end of 1979 and 1980, the number of steelmaking furnaces and continuous casting machines were as follows:[6]

Facility	Units at yearend	
	1979	1980
Basic oxygen furnaces	96	94
Electric furnaces	629	627
Continuous casting machines:		
For slabs	36	37
For blooms and billets	101	104

By yearend, Japan's annual steel production capacity was estimated at 136 million tons.

Domestic mine output of iron ore and concentrate and pyrites cinder was negligible. Japan stopped production of iron sands in 1980. Consumption of iron ore, pellets, and iron sands in 1980 was 129.3 million tons, about 5% higher than that of 1979. Japan's dependency on imports of iron ore reached 99% in 1980. During 1980, 116.4 million tons of iron ore and concentrates was imported principally from Australia (57.1 million tons), Brazil (23.0 million tons), and India (15.5 million tons). Japan also imported 17.3 million tons of sinters, pellets, and briquettes primarily from Brazil (5.5 million tons), the Philippines (4 million tons), Chile (3.1 million tons), Australia (2.9 million tons), and India (1 million tons). Consumption of other raw materials by the industry in 1980 includes 64.8 million tons of coking coal (89.4% was imported), 45.5 million tons of coke, 86.7 million tons of pig iron, 43.8 million tons of iron and steel scrap, 1.2 million tons of ferruginous manganese ore (all imported), 1.5 million tons of manganese ore, and 15.8 million tons of limestone. Consumption of fuel oil dropped 34% to 4,769,000 kiloliters in 1980. Consumption of oxygen was 5.3 billion cubic meters and electricity was 67.4 billion kilowatt-hours in 1980.

During 1980, Japan's exports of iron and

steel were 30.3 million tons, a 3.8% drop from 31.5 million tons in 1979. Exports of iron and steel were as follows in thousand tons:

	1979	1980
Pig iron	60.8	14.6
Ferroalloys	132.4	70.5
Ingots	3.3	7.2
Semifinished products	124.2	184.4
Ordinary steel products	28,244.6	27,305.1
Special steel products	1,678.7	1,590.6
Other steel products	394.4	393.1
Cast iron pipe and secondary steel products	857.9	761.7
Total	31,496.3	30,327.2

Exports to the United States were 5.2 million tons, a decline of 16%; China, 3.2 million tons, a decline of 28%; and the U.S.S.R., 1.7 million tons, a 4.4% decline. By region, exports to Southeast Asia (excluding China) showed a 9% improvement (about the 10-million-ton level). Shipments to the European Economic Community were only 633,000 tons, and to other European countries, 1.3 million tons. Exports to the Middle East remained at the 4-million-ton level, exports to Latin America were 2.6 million tons, and exports to Africa were 1.5 million tons. Iron and steel exports for 1980 were valued at $15.5 billion and accounted for about 12% of overall export earnings.

Domestic orders for ordinary and special steel products by end use were as follows in thousand tons:

	Ordinary steel products		Special steel products	
	1979	1980	1979	1980
Construction and repairing	15,283	14,845	433	441
Industrial machinery and equipment	2,215	2,435	1,010	1,079
Electrical machinery and equipment	2,460	2,524	70	73
Home and office appliances	724	752	185	199
Shipbuilding and marine equipment	2,924	3,802	59	73
Automobiles	8,543	9,470	1,376	1,487
Rolling stocks	227	245	63	69
Tanks and containers	2,042	1,841	97	130
Others	368	350	76	85
Conversion and processing	3,754	3,770	2,652	2,797
Steel dealers	15,956	15,084	901	845
Total	54,496	55,118	6,922	7,278

Demand for seamless pipes for oil drilling, as driven by thriving oil development activities, continued to increase in 1980. Demand for heavy steelplate also rose as a result of a strong recovery in orders for new vessels during 1979-80. Demand for special steel continued its 5-year upward trend in 1980, reflecting the continuous expansion of the Japanese auto industry and the industrial machinery and equipment industry.

To cope with the soaring costs of energy, Japan's major integrated steel companies had made efforts to reduce and save energy. During 1978-79, various energy conservation measures were adopted and, as a result, consumption of fuels by the industry (excluding LNG) declined 8% to 83 liters per ton of crude steel produced in 1979, and was to decline further to about 55 to 60 liters in 1980. The energy-saving measures taken by the industry during 1980 were as follows: Nippon Kokan K.K. had made an effort to reduce energy consumption at its Keihin works by recovering waste energy through the use of cold, dry quenching and maximizing energy and resource usage. A waste heat recovery system was installed in the sintering plants at its Ohgishima complex and Fukuyama works. Kawasaki Steel Corp. began to build a $4 million facility in the slag yard at its Chiba works. The facility was to recover heat from blast furnace slag to produce steam and electricity, and was expected to come onstream in the spring of 1981. At the Nippon Steel Corp., in addition to the existing four top-gas driven turbines, three other blast furnaces were to be equipped with turbines to generate electricity for general distribution by 1980. Sumitomo Metal Industries began operation of the freon-gas turbine generator at its Kashima No. 1 steelmaking plant.

Sumitomo also modified its Kashima works to use more coke than fuel in blast furnace operations. Other energy-saving measures taken by the industry include shifting toward sintered ore in pig iron making, installation of continuous casting machines, computerized energy control systems, and utilization of direct-rolling processes.

Technical cooperation between Nippon Steel (the major turnkey contractor) and China for the development of Baoshan steelworks suffered a major setback when the Chinese Government announced to postpone indefinitely the second-stage construction. As a result, Nippon Steel's share in construction of the second stage of Baoshan's steelworks would be reduced substantially. (See Iron and Steel section of the Mineral Industry of China).

In August 1980, two large steel mill joint venture projects were signed between Japan and Mexico. The first project involved building a 290,000-ton-per-year large-diameter steel pipe plant in the Lazaro Cardenas region on the west coast of Mexico. According to the agreement, Sumitoma Metal Industries, Ltd., was to build the plant by setting up a joint venture company called Japan-Mexico Large-Diameter Steel Pipe Corp. The cost of the project was estimated at $157 million, of which $95 million was to be financed by borrowing and $62 million by equity capital. The Japanese interest, led by Sumitomo, would hold 40% of the equity capital. (The Japanese interest was to be shared by Sumitomo, 60%; Overseas Economic Cooperation Fund, 30%; and other Japanese interests, 10%).

The second project involved construction of a casting and forging steel plant by Kobe Steel, Ltd., in the same region, and the setting up of another Japanese-Mexican joint venture company called Japan-Mexico Steel Casting and Forging Corp. The estimated cost of the casting and forging project was $277 million, of which $194 million was to be financed by borrowing, and $83 million by equity capital. The Japanese interests, led by Kobe Steel would hold 33% of the equity. (The Japanese interest was to be shared by Kobe, 60%; Overseas Economic Cooperation Fund, 30%; and other Japanese interests, 10%). The Government of Japan declared both projects to be national projects, therefore, these two projects would be qualified for a low-interest loan from the Japanese Government.[7]

Lead and Zinc.—Japan's mine output of lead was insignificant by world standards. Output of zinc in 1980 accounted for about 4% of the world mine production. Japan remained 1 of the world's top 10 producers of refined lead and zinc in 1980.

Based on the latest survey by the Agency of Natural Resources and Energy, Japan's total ore reserves of lead and zinc were estimated at 61,828,000 tons, averaging 6.6% zinc and 1.1% lead (zinc metal content of 4,022,000 tons, and lead metal content of 682,000 tons). The minable crude ores were estimated at 61,972,000 metric tons, averaging 5.0% zinc and 0.9% lead (with zinc metal content of 3,039,000 tons and lead metal content of 524,000 tons).[8]

Domestic mine production of lead and zinc was principally by Mitsui Mining and Smelting Co., Ltd., at Kamioka Mine in Gifu; Dowa Mining Co., Ltd., at Hanaoka Mine and Kosaka Mine, both in Akita; Syakanai Mining Co., Ltd., at Syakanai Mine also in Akita; Hosokura Mining Co., Ltd., at Hosakura Mine in Miyagi; Toyoha Mining Co., Ltd., at Toyoha Mines in Hokkaido; and Nippon Zinc Mining Co., Ltd., at Nakatatsu Mine in Fukui. Domestic mine output of lead and zinc supplied about 23% of refined lead production and about 32% of refined zinc production in 1980. During 1980, Japan imported 258,634 tons of lead ore and concentrates mainly from Canada, Peru, and Australia (these three countries accounted for 91% of total imports), and 804,851 tons of zinc mainly from Canada, Peru, and Australia (these three countries accounted for 90% of total imports). Japan also imported about 69,000 tons of refined lead principally from North Korea, Mexico, Peru, and Australia, and about 42,000 tons of refined zinc principally from North Korea and the Republic of Korea in 1980.

Production of primary refined lead and zinc in 1980 was at a slightly lower level than that of 1979 owing to the tight supply of concentrates from overseas mines and stagnant domestic demand during the second half of 1980. During 1980, capacity utilization rates at the smelters ranged from 65% to 80%. Utilization rates during the first half of 1980 were generally higher than that of the second half.

Dowa Mining's expansion project of the electrolytic lead refining facility at its Kosaka works was completed in October 1980, and raised its annual capacity to 20,800 tons from 16,800 tons.

Annual production capacity of primary lead and zinc by type of operation was as follows, in tons:

Company	Plant location	Annual capacity	
		Electrolytic	Dry smelting
LEAD			
Toho Zinc Co., Ltd	Chigirishima	72,000	--
Mitsui Mining & Smelting Co., Ltd	Kamioka	33,600	--
	Takehara	43,800	--
Nippon Mining Co., Ltd	Saganoseki	36,000	--
Mitsubishi Metal Corp	Hosokura	21,600	--
Mitsubishi Cominco Smelting Co., Ltd	Naoshima	--	36,000
Dowa Mining Co., Ltd	Kosaka	20,800	--
Rasa Industries Co., Ltd	Miyako	2,640	--
Sumiko ISP Co., Ltd.[1]	Harima	26,400	--
Total		256,840	36,000
		Annual capacity	
ZINC		Electrolytic	Distillation
Mitsui Mining & Smelting Co., Ltd	Kamioka	72,000	5,280
	Hikoshima	84,000	--
	Miike	21,600	116,400
Toho Zinc Co., Ltd	Annaka	139,200	--
	Chigirishima	--	5,160
Mitsubishi Metal Corp	Hosokura	21,600	--
	Akita	105,600	--
Nippon Mining Co., Ltd	Mikkaichi	--	120,000
Nisso Metal Co., Ltd	Aizu	31,200	--
Hachinohe Smelting Co., Ltd	Hachinohe	--	84,000
Sumiko ISP Co., Ltd.[1]	Harima	--	79,200
Akita Smelting Co., Ltd	Iijima	156,000	--
Total		631,200	410,040

[1]Wholly owned subsidiary of Sumitomo Metal Mining beginning Oct. 1, 1980.

For 1980 as a whole, the industry was operating at 75% of capacity for primary lead and 71% of capacity for primary zinc. Production of secondary lead and zinc in 1980 was at a higher level than that of 1979 owing to a strong domestic demand for the secondary metals by the manufacturers of storage batteries, galvanized sheets, die casting, and brass.

Domestic consumption of primary lead rose 4.4% to 279,000 tons in 1980. By end uses, storage batteries were 45% of the total, inorganic chemical was 23%, lead pipe and sheet were 7.5%, cable sheathing was 9.5%, and others were 15%. Consumption of primary zinc dropped 2.6% to 735,000 tons in 1980. By end uses, sheet galvanizing was 41%; wire, tube, and general galvanizing were 17%; brass and rolled zinc were 18%; and others were 24%.

Stocks at producer plants for primary lead were 13,081 tons at the end of 1980 compared with 12,947 tons for 1979, and for primary zinc, stocks were 108,371 tons at the end of 1980 compared with 96,007 tons for 1979.

During 1980, Japan exported about 5,000 tons of refined lead mainly to the Republic of Korea (2,040 tons) and Cuba (1,313 tons); 41,700 tons of refined zinc was exported mainly to Taiwan (7,861 tons), the Republic of Korea (7,422 tons), the Philippines (6,507 tons), the U.S.S.R. (4,497 tons), Nigeria (3,581 tons), Indonesia (2,417 tons), and Thailand (2,281 tons).

The industry was also facing the problem of high energy costs. The price of electricity used by the industry was raised by 56% in April of 1980. As a result, production was cut back and many smelters had made efforts to reduce energy consumption by increasing the proportion of nighttime electricity use (at lower prices), recycling hot waste gases, and other means. In 1980, about 60% of the production cost was attributable to the power cost of the Japanese smelters.

A joint venture company was established in December 1980 between a Japanese consortium, composed of Mitsubishi Metal and Mitsubishi Corp., and Compañía Mineral Milpo S.A. of Peru, for the exploration of lead and zinc deposits in central Peru. The prospecting work was expected to start early in 1981 in a concession area at San Hilarion (about 459 kilometers from Lima), where the ore reserves were estimated at about 10 million tons containing lead, zinc, and silver. The estimated cost of the prospecting work was about $2 million. Milpo was to own 65% of the equity capital and mining rights of the Hilarion deposits, and

the remaining 35% was to be equally shared by the two Mitsubishi companies.

Magnesium.—Production of primary magnesium was by Furukawa Magnesium Co., Ltd., at Koyama with an installed annual capacity of 6,000 tons, and Ube Industries, Ltd. (Ube Kosan), at Yamagachi with an installed annual capacity of 7,000 tons. Production of primary magnesium metal in 1980 declined 18.6% to under 10,000 tons owing to a drastically reduced demand from light metal rolling and casting and increasingly cheaper imports brought about by the appreciation of the Japanese yen. The industry was operating at about 60% of its installed capacity for 1980.

In 1980, Japan imported 12,476 tons of magnesium ingots principally from the United States (8,673 tons), Norway (1,777 tons), and Canada (1,546 tons).

Total demand for primary magnesium metals in 1980 was 18,270 tons. In addition, 24,820 tons was utilized as a reducing agent for the production of titanium and zirconium. Other main users of the metals were light metal rollings (6,760 tons), aluminum alloys (5,457), nodular cast iron (2,031 tons), and powder (1,129 tons). During 1980, Japan exported about 90 tons of magnesium mainly to the Republic of Korea (53 tons) and North Korea (30 tons).

Manganese.—Domestic mine production of manganese ore continued to decline in 1980. About 75% of total mine output was from three major mining operations at the Ooe Mine and at the Inakunaishi Mine of Hokushin Mining Co., Ltd., and at the Jokoku Mine of Chuugai Mining Co., Ltd.; all are in Hokkaido. Japan's manganese ore reserves were estimated at 3,182,000 tons averaging 20.7% manganese (manganese metal content of 658,600 tons). The minable crude ores were estimated at 3,193,000 tons, averaging 16.6% manganese (manganese metal content of 529,100 tons). Because of the insignificant quantity and low-grade manganese ore of domestic mine output, most of Japan's requirements for manganese were met by imports. During 1980, Japan imported about 1.8 million tons of manganese ore and concentrates (excluding ores and concentrates of manganese dioxide and ferruginous manganese). The main supplying countries were the Republic of South Africa (760,721 tons), Australia (601,762 tons), Gabon (150,427 tons), and Brazil (149,235 tons). Japan also imported about 1.1 million tons of ferruginous manganese ore and concentrates principally from the Republic of South Africa (537,975 tons) and India (515,769 tons) in 1980.

Over 90% of manganese ore was consumed by the iron and steel and ferroalloy industries. The remainder was for the manufacturing of electrolytic manganese for welding rod and chemical use.

During 1980, Japan imported 26,872 tons of manganese dioxide ore and concentrate, mainly from Australia (11,069 tons), Gabon (8,135 tons), and China (3,089 tons), for the production of manganese dioxide.

Production of manganese metal in 1980 was by Chuo Denki Kagyo and Toyo Soda with a combined annual capacity of 9,600 tons. The former sold the metal only in the domestic market through Sumitomo Corp., and the latter sold both in the domestic and the international markets through Mitsui & Co. and Mitsubishi Corp.

Production of manganese dioxide in 1980 was by Toyo Soda Manufacturing Co., Mitsui Mining and Smelting Co., and Daiichi Carbon Co. Toyo Soda has plants at Hinata in Shizuoka Prefecture with an annual capacity of 18,000 tons, and a joint venture company, Tekkosha Hellas A.B.E. in Greece, with an annual capacity of 10,000 tons. Mitsui Mining & Smelting has plants at Takehara in Hiroshima Prefecture with an annual capacity of 19,000 tons, and a joint venture company, Mitsui Denman in Ireland, with an annual capacity of 12,000 tons. Daiichi Carbon has an annual capacity of 4,000 tons. Owing to the rapid growth in demand for the manganese dioxide used in electric cells, a new company, Japan Metals and Chemicals Co., was expected to join the industry. The company was to complete a $14.3 million ore reduction and electrolysis facility at Takaoka and begin operation in early 1981 with an annual capacity of 6,000 tons. In addition, Toyo Soda was expanding its Hinatu's capacity from 18,000 to 24,000 tons per year by April 1981. Toyo Soda also decided to build a $20 million plant with an annual capacity of 12,000 tons by mid-1983. Mitsui was also expected to raise capacity at its Takehara plant from 19,000 to 25,000 tons per year by August 1981 with an estimated cost of $14.3 million.

Molybdenum.—Domestic production of molybdenum concentrate declined to about the 110-ton level in 1980. Mine output was by Taenaka Mining Co., Ltd., at the Higashiyama Mine and at the Komagi Mine in Shimane Prefecture. Imports of molybdenum concentrates totaled 20,278 tons for 1980. The major suppliers were the United States (10,530 tons), Canada (6,190 tons),

and Chile (2,525 tons). Japan also imported about 100 tons of molybdenum ore mainly from the United States and the Federal Republic of Germany.

Consumption of molybdenum ore and concentrates was by the manufacturers of molybdenum metal, ferromolybdenum, and other fabricated metal products such as wires, rods, and sheet.

Molybdenum metal production for 1980 was estimated at about 400 tons, while output of ferromolybdenum in 1980 was 4,367 tons.

Nickel.—Production of nickel metal in 1980 was slightly below the level of 1979. Sumitomo Metal Mining and Nippon Mining were the only two producers operating in 1980. Japan's requirements for nickel ore and concentrates of about 4 million tons per year were imported from New Caledonia (51%), Indonesia (33%), and the Philippines (16%). During 1980, Japan also imported about 52,000 tons of nickel matte principally from Indonesia (52%), Australia (38%), and New Caledonia (9%) and about 15,000 tons of refined nickel mainly from Canada (27%), the U.S.S.R. (16%), Australia (15%), Norway (13%), the Philippines (11%), and the Republic of South Africa (8%).

Consumption of nickel metal in 1980 was 36,539 tons, about 5,000 tons higher than that of 1979. The increased demand was due to an increase in the production of nonferrous alloys. By end use, consumption for specialty steel accounted for 37%; nonferrous alloys, 20%; plating, 19%; magnetic materials, 8%; fabricated products, 6%; and others, 10%.

Japan also consumed about 76,000 tons of nickel for the manufacture of ferronickel by the ferroalloy industry, and about 12,000 tons of nickel for the production of nickel oxide in 1980.

Tin.—Mine output of tin concentrates declined in 1980. Production was by Akenobe Mining Co., Ltd., at the Akenobe Mine (a copper-zinc-tin operation) in Hyogo Prefecture. The concentrates were shipped to Mitsubishi Metal Corp. for refining at its Naoshima plant in Kagawa Prefecture. During 1980, Japan imported only 14 tons of tin ore and concentrates from Laos. Japan's output of refined tin in 1980 was 1,319 tons.

During 1980, Japan imported 31,068 tons of refined tin mainly from Malaysia (18,455 tons), Indonesia (6,324 tons), Thailand (6,166 tons), and China (84 tons).

Consumption of tin in Japan was mainly by the manufacturers of tin plate (40%), solder (33%), stabilizer for vinyl chloride (7%), wire and cable (4%), and fabricated copper and casted copper alloy (5%). Other uses of tin were for abrasives and galvanizing.

As of April 1978, estimated tin ore reserves in Japan were 1,147,000 tons averaging 1.08% tin. The minable crude ore was estimated at 1,528,000 tons averaging 0.71% tin.

Titanium.—Japan was the world's second largest titanium sponge producer following the U.S.S.R. In 1980, output of titanium sponge reached another record high at 19,400 tons, as a result of expanded capacity boosted by growing demand for the metal both in domestic and international markets. During 1980, two Japanese producers were operating at nearly full capacity of about 21,000 tons per year.

During 1980, Japan imported 409,080 tons of rutile and ilmenite. The principal supplying countries were Malaysia (including Sabah), accounting for 45%; Australia, 27%; India, 12%; and Sri Lanka, 10%.

About 8,000 tons of the total sponge production in 1980 was exported mainly to the United States (3,332 tons, or equivalent to 72% of the United States' total imports), the United Kingdom (2,451 tons), and the Netherlands (1,870 tons). The remaining titanium sponge was for inventory and domestic consumption by the manufacturers of titanium tubes, pipes, plates, and condensers for nuclear powerplants, chemical and power products, and ferroalloy products.

Osaka Titanium Co., Ltd., completed the construction work for the expansion of titanium production capacity at Amagasaki in Hyogo Prefecture to 12,000 tons per year in November 1980 at a cost of $12 million. The company planned to raise the capacity by 1,200 tons in April 1981. Osaka produced an additional 2,000 tons of titanium sponge in 1980 at Nihongi in Niigata Prefecture under a toll-smelting contract with New Metals Industries Co., a subsidiary of Nippon Soda Co., Ltd. Nippon Soda was expected to expand its annual capacity to 2,500 tons in April 1981. In 1981, Osaka's annual capacity was expected to reach 15,200 tons including that of toll smelting by Nippon Soda, surpassing Titanium Metals Corp. of America of the United States (15,000 tons per year).

Toho Titanium Co., Ltd., has been expanding its capacity at Chigasaki in Kanagawa since June 1980. Upon completion of the expansion by the spring of 1981, Toho was expected to raise its production capaci-

ty from 8,400 to 10,800 tons per year.

During 1980, the two Japanese companies had made an effort to cut down the power requirements for the production of titanium. As a result, approximately 30,000 kilowatt-hours of electricity required for 1 ton of titanium sponge was reduced to about 25,000 kilowatt-hours.

Exports of Japan's titanium sponge to the United States were normally under long-term contracts with prices being renegotiated annually. Based on the new contracts, Japan's titanium sponge would be priced between $7.50 and $8.50 per pound c.i.f. or $8.85 and $10.03 per pound, duty paid, starting in April 1981. In 1981, the duty-paid prices of Japan's titanium sponge under the old contracts were between $7.50 and $8.70 per pound.[9]

Tungsten.—Domestic mine output of tungsten ore and concentrate declined in 1980 owing to the falling quality of ore in various mines. In 1980, the leading producers were Kaneuchi Mining Co., Ltd., which operated the Kaneuchi Mine in Kyoto Prefecture and the Fujigatani Mine in Yamaguchi Prefecture; Awamura Mining Co., Ltd., which operated the Otani Mine in Kyoto Prefecture; Yaguki Mining Co., Ltd., which operated the Yaguki Mine in Fukushima Prefecture; Chitose Mining Co., Ltd., which operated the Takatori Mine in Ibaraki Prefecture; and Tanaka Mining Co., Ltd., which operated the Kuga Mine in Yamaguchi Prefecture. During 1980, Japan imported 3,480 tons of tungsten ore and concentrates mainly from the Republic of Korea (733 tons), Canada (675 tons), Australia (557 tons), Portugal (355 tons), Bolivia (299 tons), and other countries including Peru, Thailand, China, and the United States.

Consumption of tungsten ore in Japan was mainly by the manufacturers of tungsten metal and ferrotungsten. Output of tungsten metal in 1980 was estimated at about 2,000 tons, while output of ferrotungsten was about 240 tons.

In 1980, two tungsten deposits were discovered in the Nishikigawa district of Yamaguchi Prefecture. Seven mineralized veins occur at about 2 kilometers west of the Kuga Mine of Tanaka Mining Co. The ore contains an average of 2% to 3% tungsten. The other site, located 1 kilometer west of the Kichita Mine in the Nishikigawa district, has a thicker vein. The ore contains an average of 3.7% tungsten.[10]

As of April 1, 1979, Japan's tungsten ore reserves were estimated at 3,565,900 tons averaging 0.71% WO_3, and minable crude ores were estimated at 4,551,100 tons averaging 0.46% WO_3.

Other Metals.—Japan's requirements for antimony were all imported from overseas sources. During 1980, about 7,000 tons of antimony ore and concentrates were imported from Bolivia (87%), the Republic of South Africa (6%), Thailand (6%), and Malaysia (Sarawak) (1%). Imports of refined antimony were about 1,560 tons. China alone supplied 95%; the remainder of the imports were from Bolivia and Vietnam. There was a sharp fall in ingot production owing to the reduced demand for antimony alloy battery plate following the continuing success of maintenance-free battery production in Japan. However, production of antimony trioxide increased in 1980, and was mainly used in the manufacture of flame-resistant materials, glass, and enamel.

Production of cadmium declined to about the 2,200-ton level. Cadmium was produced as a byproduct of zinc smelting. Six producers were Mitsui Mining and Smelting Co., Ltd.; Mitsubishi Metal Corp.; Sumitomo Metal Smelting Co.; Nippon Mining Co.; Dowa Mining Co.; and Toho Zinc Co. About half of the total output was consumed domestically by the makers of nickel-cadmium batteries for emergency lights, the manufacturers of fire alarms in building blocks, and for the production of pigments and alloy additives. The remaining 50% was exported mainly to the United Kingdom, the Federal Republic of Germany, the Netherlands, Taiwan, and East European countries. Japan also exported about 230 tons of cadmium alloys to the Netherlands, the United Kingdom, Romania, the Republic of South Africa, Taiwan, and the Southeast Asian countries. The export price of Japanese cadmium in 1980 was based on London Metal Bulletin quotations.

Japan's mine production of chromium ore and concentrates increased slightly in 1980 to about 14,000 tons containing 32% chromium. The two domestic producers were Hirose Mining Co., Ltd., which operated the Hirose Mine, and Nihon Chromium Mining Co., Ltd., which operated the Wakamatsu Mine. Domestic consumption of chromium ore and concentrates by the ferroalloy industry alone totaled 798,066 tons in 1980. Over 95% of Japan's requirements for chromium ore and concentrates were imported. During 1980, Japan imported 950,039 tons of chromium ore and concentrates from the Republic of South Africa (43%), the Philippines (22%), India (18%), the U.S.S.R. (4%),

Madagascar (3%), Turkey (3%), Brazil (2%), and the remaining 5% was from nine other countries. During 1980, Japan also imported 257,157 tons of ferrochromium, of which 201,955 tons was imported from the Republic of South Africa. Chromium metal production was mainly by Toyo Soda in 1980. Consumption of chromium metal was by the manufacturers of superalloys (43%), aluminum and copper alloy (32%), welding rods (23%), and other uses (2%).

In April 1980, Japan withdrew from a joint venture project to exploit the Serjana chromite mine in Brazil. The Japanese consortium reportedly received $1.9 million from Cia. de Ferro-Ligas da Bahia S.A. (Ferbasa) for selling its share to Ferbasa, the largest Brazilian producer of chromite. The high costs of shipping the ore and the planned reduction in the Japanese ferrochromium capacity were cited as the main reasons for the withdrawal.

Japan was the world's fourth largest producer of cobalt metal in 1980. Production of the metal, a byproduct of copper and nickel refining, was 2,867 tons in 1980, of which about 960 tons of toll-refined metal was shipped back to foreign customers. During 1980, Japan imported 1,606 tons of cobalt and cobalt alloy, principally from Zaire and Belgium. Domestic consumption of cobalt metal was 1,914 tons in 1980, of which 385 tons was consumed by the makers of high-speed steel, other alloy steels, and heat-resisting alloys; 668 tons for magnetic materials; 165 tons for cemented carbides; 98 tons for catalysts; and 598 tons for other uses.

Japan's mine output of gold and silver continued to decline. Mine production in 1980 was by Mitsui Kushikino Mining Co., Ltd., at the Kushikino Mine in Kagoshima Prefecture, and Chitose Mining Co., Ltd., at the Chitose Mine in Hokkaido. Other important gold and silver mines were the Kasuga Mine (gold only) of Kasuga Mining Co., Ltd.; the Asahi Mine of U.R.I. Mining Co., Ltd.; the Mochikoshi Mine of Chigai Mining Co., Ltd.; the Sado Mine of Sado Mining Co., Ltd.; and the Nebazawa Mine of Arakawa Mining Co., Ltd. During 1980, Japan imported 889,000 troy ounces of gold mainly from Switzerland (52%), the United Kingdom (37%), the U.S.S.R. (9%), and other countries (2%). Imports of silver totaled 18.1 million troy ounces, of which 64% was from Mexico, 22% from Peru, 9% from Australia, and 5% from other countries.

Japan also obtained substantial amounts of gold and silver by recycling. During FY 1979, 997,000 troy ounces of gold and 4,115,000 troy ounces of silver were recovered. Domestic demand for gold in FY 1979 was estimated at about 4.6 million troy ounces. Consumption was for ornaments (jewelry), 32%; private hoarding, 24%; plating, 14%; electronic communication, 10%; dentistry, 8%; handicrafts, 3%; and other, 9%. Domestic demand for silver in FY 1979 was 71 million troy ounces. About 48% was for silver nitrate sensitive film, 10% for other silver nitrate, 13% for point connectors, 7% for rolled sheet, 7% for silver solder, and 15% for all other uses.

Indium production in 1980 was estimated at about 12 tons. Nippon Mining increased its monthly output from 500 to 750 kilograms in mid-1980. Dowa Mining's monthly output remained at a 300-kilogram level. Mitsui Metal and Sumitomo Metal Mining supplied a total of about 1,000 kilograms of indium by recycling scrap. During 1980, Japan imported 2,811 kilograms of refined indium principally from Canada (1,200 kilograms), Belgium (701 kilograms), China (344 kilograms), and the Federal Republic of Germany (340 kilograms). Indium was used in electronic components, solders, and other alloys.

Mitsui & Co. and Ishizuka Research, Inc., announced a new technology for zirconium sponge production. After 12 years of research at Hiratsuka, east of Tokyo, with an investment of $2.7 million by both companies, a new method of extracting zirconium, known as distillation with differential partial condensation, was developed in mid-1980. The two companies established a joint venture firm and were expected to start with an initial monthly output of 10 to 15 tons of sponge per month in December 1980 and gradually increase to 100 tons per month in 1982. The production cost of zirconium by the new method was estimated at $3.30 per pound compared with about $6 to $7 per pound under the conventional method. During 1980, the market price of zirconium sponge was about $10 per pound.[11]

Japan also produced other metals and compounds of high purity and of significant quality by world standards. These metals included cerium, germanium, germanium oxide, lanthanum oxide, selenium, silicon, tantalum, tellurium, and uranium. Most of the output of these metals was from imported materials.

NONMETALS

Cement.—In 1980, Japan's cement industry consisted of 24 firms operating 60 plants and 202 kilns. The industry's total annual

production capacity was 116 million tons. Japan remained one of the world's leading cement producers in terms of output, technology, and exports.

Onoda Cement Co., Ltd., and Nippon Cement Co., Ltd., were the two oldest and largest cement producers, followed by Sumitomo Cement Co., Ltd.; Mitsubishi Mining and Cement Co., Ltd.; Ube Industries, Ltd.; Chichibu Cement Co., Ltd.; and Osaka Cement Co., Ltd. The industry's labor force was estimated at 11,000 persons compared with 11,800 persons in 1979. Japan ranked first in labor productivity of cement production in the world. In 1980, the industry's annual output per worker was 7,945 tons compared with France (2,751 tons), the United States (2,616 tons), and the Federal Republic of Germany (2,200 tons).[12]

For the past 2 years, varieties of new cement products were successfully introduced into the market by Chichibu Cement Co. The new products included cement that is capable of solidifying in the presence of various deterrents to hardening, that can resist too much water during application, and that can quickly solidify. Creation of a special clinker of the aluminate group was cited as the key to the new products.

Nippon Cement Co. started to operate its newest and largest vertical mill at Kamiiso in 1979. The 2,700-kilowatt raw mill was capable of grinding a harder limestone with a throughput of 350 tons per hour.

Similar to its aluminum industry, Japan's cement industry was also experiencing serious problems of soaring fuel costs. The industry required an average of about 80 liters of "C" type fuel oil to produce each ton of clinker. In 1980, based on the industry's average, energy cost accounted for more than 60% of the production cost. To reduce energy cost, the industry continued its efforts to switch from type C fuel oil to coal. According to an industry source, about 90% of the industry's total fuel consumption was expected to be based on coal by mid-1981. To supplement coal, the industry was successfully utilizing waste tires as fuel for cement production. The technology of utilizing waste tires was jointly developed by the Nippon Cement Co. and the Bridgeston Tire Co. in 1978.

According to the Cement Association of Japan, domestic shipments of cement totaled 82.4 million tons and exports totaled 8.6 million tons in 1980. Of the total demand in 1979, about 58.8% was shipped to the fresh concrete industry composed of more than 4,800 medium- and small-sized operators in the country, and about 13.5% to cement product manufacturers. Domestic cement consumption by other end uses was civil engineering, 2.7%; private buildings, 2.5%; public buildings, 1.1%; roads and bridges, 0.9%; electric powerplants, 0.7%; harbors and airports, 0.4%; railways, 0.2%; for own use, 0.1%; and other, 7.8%. About 11.3% was exported, principally to Saudi Arabia, Kuwait, and other Middle and Near East oil-producing countries, and Singapore and Hong Kong. The distribution of cement in the domestic market and exports of cement to the principal overseas market remained substantially the same in 1980.

Fertilizer Materials.—In 1980, Japan's fertilizer industry was still being considered as one of the world's largest, although the production capacity had been reduced substantially during the past 2 years as recommended by the Industrial Structure Council in May 1978. As a result of price increases in raw materials including naphtha and liquefied petroleum gas (LPG), low level of domestic demand, the deterioration of international competitiveness, self-supply policy of developing countries, and the appreciation of the Japanese yen, Japanese fertilizer production and exports continued to decline in 1980.

During 1980, the annual output capacity of ammonia was reduced from 3.7 million to 3.4 million tons, and was operating at about 70% capacity. During the 1979-80 period, Japan produced 1.9 million tons of ammonium sulfate, of which about 1.2 million tons was for the manufacture of fertilizer, 26,000 tons was for industrial use, and the remaining 700,000 tons was for exports, mainly to China. During 1980, the annual output capacity of urea was also reduced from 2.6 million to 2.3 million tons, and was operating at about 68% of capacity. During the 1979-80 period, total output of urea was about 2 million tons, of which about 400,000 tons was for fertilizer use, about 600,000 tons was for industrial use, and about 1 million tons was for exports, mainly to China.

During 1980, Japan's fertilizer exports to China remained favorable. However, exports to the Philippines, Pakistan, Sri Lanka, and New Zealand decreased sharply because large quantities of urea were offered to these consuming countries by low-cost suppliers such as Iraq, Kuwait, and Saudi Arabia.

In 1980, Japan's ammonia and nitrogen fertilizer industry also produced about 650,000 tons of ammonium chloride. About

40% was for domestic use, 5% was for industrial use, and the remainder was exported. Calcium cyanamide production remained at 181,000 tons; about 93% was for domestic fertilizer use and the remainder was for industrial use. Exports of calcium cyanamide were insignificant at about the 5,000-ton level.

Japan's phosphatic and compound fertilizer industry also suffered from excess output capacity. Based on the Industrial Structure Council's recommendation, about 20% of wet phosphatic fertilizer production equipment was to be scrapped, imports of phosphates were to be restricted, and the system of distribution and pricing were to be rationalized. During 1979, the industry's production facilities were curtailed by 17%. Imports of secondary phosphoric acid products including phosphoric acid liquid, ammonium phosphate, and double superphosphate of lime were reduced because of higher import prices. As a result, the supply and demand situation began to improve in 1980.

Japan's annual output capacity of calcium superphosphate was about 2 million tons. During 1980, the industry was operating at about 25% to 30% of capacity. Fused magnesium phosphate was operating at about 50% of its 1-million-ton capacity.

During the 1979-80 period, Japan produced about 540,000 tons of calcium superphosphate and about 450,000 tons of fused magnesium phosphate. Production of high-analysis compound fertilizer was about 3.2 million tons, of which 3 million tons was consumed domestically. Exports of high-analysis compound fertilizer were about 120,000 tons, mainly to Thailand, Indonesia, and Malaysia. Japan also produced about 690,000 tons of low-analysis compound fertilizer and about 200,000 tons of nitrogen and potassium compounds, mainly for domestic consumption. Japan's requirements for phosphate were 100% dependent on foreign sources. In 1980, Japan imported 2.8 million tons of phosphate rock mainly from the United States (1.9 million tons) and Morocco (645,000 tons). Japan also imported 100% of its potash requirements mainly from Canada (60%) and the U.S.S.R. (20%). Imports of potassium chloride in the 1979-80 period totaled about 642,000 tons (in K_2O). Imports of potassium sulfate totaled about 125,000 tons (in K_2O), mainly from France, the Federal Republic of Germany, and the United States.

Japan's production of potassium sulfate was only about 43,000 tons, compared with annual requirements for potassic fertilizer at about 780,000 tons in the 1979-80 period. The Nippon Kasei Chemical Co., Ltd., began the construction work of a potassium sulfate plant and its Onahama complex in Fukushima Prefecture in mid-1980. The 10,000-ton-per-year-capacity plant was expected to come onstream in March 1981. Plant construction was by Chisso Engineering Co., Ltd. Potassium chloride would be imported, but the sulfuric acid would be supplied by domestic sources.[13]

Gypsum.—Japan stopped mine production of natural gypsum in 1978. According to a recent report published by MITI, the estimated gypsum supply and demand situation in Japan from 1979 to 1983 was summarized as follows, in thousand tons of $CaSO_4 \cdot 2H_2O$:

	1979	1980	1981	1982	1983
Demand					
Cement	2,659	2,595	2,638	2,691	2,745
Boards	2,230	2,286	2,187	2,328	2,479
Plaster	430	395	375	357	338
Calcined gypsum	95	100	105	110	115
Other	241	273	294	309	321
Exports	444	450	400	400	400
Total	6,099	6,099	5,999	6,195	6,398
Supply					
Production byproducts:					
Phosphoric and flue gas desulfurization	5,063	4,837	4,855	5,063	5,310
Titanium	347	388	389	394	394
Hydrofluoric acid	396	419	429	441	450
Mineral water refining	252	243	243	243	243
Other	215	218	221	222	222
Imports	37	43	45	45	45
Total	6,310	6,148	6,182	6,408	6,664

The industry maintained about 1.2 million tons of inventory at the end of 1979. During 1980-83, the inventory was expected to remain at less than the 1-million-ton level.

Iodine.—Japan's iodine production in 1980 remained at about the 6,000-ton level. Total industry installed production capacity in 1980 was 9,700 tons per year. Japan remained the dominant producer of iodine in the world, accounting for about 58% of the world's total output (10,400 tons), followed by Chile (2,000 tons), the United States (1,200) tons, and the U.S.S.R. (1,000 tons). The largest single producer of iodine in Japan was Ise Chemical Industries Co. followed by United Resources Industry Co. and four small producers.

For the past 2 years, the industry has moved to other areas including Okinawa and overseas to expand its production capacity to offset the declining production owing to ground sinking problems in Chiba Prefecture, where most of the Japanese natural brine was concentrated. Ise Chemical Industries Co. recently resumed a long-pending joint venture project in Indonesia. United Resources Industry Co. established Godoe, Inc., in Oklahoma (United States), to produce iodine using salt water purchased from a local producer. United Resources also participated in Okinawa Natural Gas Development Co. (tentative name) jointly with Ryukyu Oil Corp. and Okinawa Gas Co. for the manufacture of iodine in Okinawa. By mid-1983, the joint venture company was expected to produce iodine at an annual rate of about 200 to 250 tons using salt to be purchased from Okinawa Gas Co.

Japan exported about 90% of its total sales, mainly to the United States and Western European countries. Applications of iodine in Japan included synthetic rubber, acetic acid by the methanol process, stabilizers for synthetic fibers, additives for feedstock, pharmaceuticals, and disinfectants.

Limestone.—Japan was the third largest limestone producer in the world in 1979, following the United States and the U.S.S.R. Production of limestone increased at an average annual rate of about 7% during 1975-79. The industry was composed of 246 companies operating 312 quarries with a labor force of about 10,500 workers. The top five producers were Ube Industrial Co., Ltd. (13.4 million tons), operating the Isa Mine; Mitsubishi Mining Cement Co., Ltd. (9.4 million tons), operating the Higashitani Mine; Nittetsu Mining Co., Ltd. (9.3 million tons), operating the Torigatayama Mine; Todaka Mining Co., Ltd. (9.2 million tons), operating the Todaka-Tsukumi Mine; and Onoda Cement Co., Ltd. (8.2 million tons), operating the Onoda-Tsukumi Mine.

Limestone deposits are widely distributed throughout Japan. Good-quality Japanese limestone normally contains 98% $CaCO_3$. According to the Agency of Natural Resources and Energy of Japan, as of April 1977, limestone reserves in Japan were estimated at 53.8 billion tons averaging 54.2% $CaCO_3$, while the minable limestone was estimated at 36.5 billion tons averaging 54.2% $CaCO_3$.

In 1979, about 58% of total output was consumed by the cement industry and about 12% was consumed by the steel industry as flux. Other main uses included aggregate (18%), lime (6%), filler and fertilizer (3%), soda and glass (1%), and all other (2%).

Salt.—Domestic production of salt in 1980 remained at about the 1-million-ton level. However, Japan imported about 88% of its total requirements for salt in 1980. During 1980, Japan's imports of salt, including industrial-use and common salt for retail sales, totaled 7,477,049 tons compared with 6,817,543 tons in 1979. Principal overseas suppliers were Mexico 50%; Australia, 40%; and China, 9%. The average unit value of all imported salt was estimated at $24 per ton compared with about $18 per ton in 1979. The average unit value of Mexican salt in 1980 was the cheapest at $22.90 per ton, Chinese salt was $23.50 per ton, and Australian salt was $26 per ton. Imports of common salt for general use totaled only 3,102 tons and was imported mainly from the United States (2,602 tons) and the Federal Republic of Germany (550 tons).

Consumption of salt in 1980 was estimated at about 8.5 million tons, of which about 6.8 million tons was consumed principally by the chlora-alkali industry. Production of salt for general consumption, including refined, common, ordinary, crushed, raw, and table salt, was estimated at about 1.6 million tons in 1980.

In 1980, production of caustic soda was 3,132,789 tons. About 3.1 million tons was delivered to the domestic market, and about 192,000 tons was exported. Japan also imported 34,000 tons of caustic soda in liquid form (a major portion) mainly from the Dow Chemical Co. of the United States and Dow Chemical Korea. During 1980, Japan's caustic soda industry was operating at about

70% of its 4.5-million-ton-per-year capacity. Production of soda ash totaled about 1.35 million tons. Practically all of the output was delivered to the domestic market.

Since July 1979, an export cartel on caustic soda was being carried out by 15 companies headed by Toyo Soda Manufacturing Co., Ltd., and Asahi Glass Co. under the approval of MITI. By December 1980, seven companies headed by Showa Denko, K.K., and Sumitomo Chemical Co. had joined the cartel.

Sulfur.—Japan's output of sulfur, recovered from petroleum refining, increased from 808,000 tons in 1975 to 1,256,000 tons in 1979 owing to the stepped-up regulations of environmental pollution by the Japanese Government. Output of sulfur by petroleum refining for FY 1980 was estimated at 1,276,000 tons, of which 867,000 tons was delivered mainly to the manufacturers of sulfuric acid and to other users, and about 410,000 tons was exported, mainly to the Republic of Korea (74%). Sulfuric acid production in FY 1980 was down slightly from that of FY 1979. Both domestic demand for sulfuric acid and exports were at about the same level as that of FY 1979.

Production and demand estimates of sulfur and of sulfuric acid for FY 1979 and FY 1980 released by the Japanese Sulfur and Sulfuric Acid Subcommittee of the Mining Industrial Council were as follows, in thousand tons for sulfur and thousand tons of 100% H_2SO_4 for sulfuric acid:

	FY 1979	FY 1980
Sulfur:		
Production	1,256	1,276
Domestic demand	838	867
Sulfuric acid	544	583
Other	294	284
Exports	420	410
Sulfuric acid:		
Production	6,680	6,660
Smelter gas	3,821	3,730
Pyrites (sulfide ore)	926	875
Sulfur	1,641	1,750
Other	292	305
Domestic demand	6,360	6,359
Fertilizer	2,121	2,152
Industrial use	4,239	4,207
Exports	371	268

Inventories of sulfur at the beginning and at the end of FY 1980 were 147,000 tons and 146,000 tons, respectively. Inventories of sulfuric acid at the beginning and at the end of FY 1980 were 132,000 tons and 165,000 tons, respectively.

The annual installed production capacity of Japan's sulfuric acid was about 9.3 million tons. During 1980, the industry was operating at about 70% of its capacity. The industry was composed of 56 plants owned by 43 companies at the end of 1979.

MINERAL FUELS

Japan's primary energy supply in FY 1979 (ending March 31, 1980) was estimated, by the Natural Resources and Energy Agency of MITI, at 4,087.4 trillion kilocalories or 7,473,000 barrels per day of oil equivalent, about 6% higher than FY 1978. In FY 1979, Japan relied on overseas sources for 87% of its primary energy supply and the remaining 13% was supplied by domestic coal, hydropower, nuclear power, and insignificant quantities of domestic crude petroleum and natural gas. Japan's primary energy supply in FY 1979 was summarized as follows:

	Quantity	Billion kilocalories	Oil equivalent (thousand barrels per day)	Percent
Petroleum:				
Domestic crude	551,000 kiloliters	5,180	9	0.13
Imported crude	273,752,000 kiloliters	2,573,270	4,705	62.95
Imported products	23,242,000 kiloliters	212,600	389	5.20
Imported LPG	9,669,000 tons	116,020	212	2.84
Coal:				
Domestic	18,880,000 tons	119,490	219	2.92
Imported	59,385,000 tons	454,740	831	11.13
Hydropower	85,044 million kilowatt-hours	208,360	381	5.10
Nuclear power	70,393 million kilowatt-hours	172,460	315	4.22
Imported LNG	14,858,000 tons	197,610	361	4.83
Natural gas	2,630 million cubic meters	25,270	46	.62
Other		2,380	5	.06
Total		4,087,380	7,473	100.00

Based on a revised long-term energy supply and demand forecast, total primary energy supply was to be increased from 7,473,000 barrels per day of oil equivalent in FY 1979 to 12,100,000 barrels per day in FY 1990. The Japanese Government was aiming to reduce the share of oil imports from 71% in FY 1979 to 50% by FY 1990. Moreover, the share of coal imports including coking and steam coal was to rise from 11% to 15.6%; LNG imports from 4.8% to 9.0%; nuclear power from 4.2% to 10.9%; and all others including domestic crude and natural gas, domestic coal, hydropower, geothermal energy, new energies, and other sources from 9% to 14.5%. In other words, Japan's oil import was to be kept below 366 million kiloliters per year, while imports of steam coal and LNG were to be raised to 535 million and 45 million tons, respectively, and the generation of nuclear power is to be increased to the 53-million-kilowatt level by FY 1990.

In 1979, Japan was the second largest energy-consuming nation of the industrialized world after the United States. Japan's total energy consumption in 1979 was estimated at about 378 million tons of oil equivalent. However, Japan's per capita annual energy consumption was the lowest among advanced industrial nations. Japan's per capita annual energy consumption was estimated at 2.3 tons of oil equivalent compared with the United States at 6.2 tons, Canada at 6.0 tons, the Federal Republic of Germany at 3.3 tons, France at 2.7 tons, and the United Kingdom at 2.6 tons.[14]

Coal.—Japan's domestic coal production in 1980 increased slightly over that of 1979, but was 2 million tons short of the 20-million-ton target set by the Government's national policy on domestic coal mining. During FY 1979, domestic coal production was principally by 9 large coal mining firms (accounting for about 95% of the total output) and 11 small mining firms. As of March 1980, coal production by the top nine producers in FY 1979 by company and by location of colliery was as follows, in thousand tons:

Company	Location of colliery	Production
Mitsui Coal Mining Co., Ltd	Ashibetsu-shi, Hokkaido	1,027
	Kamisunagawa-machi, Hokkaido	1,040
	Omuta-shi, Fukuoka, Kyushu	5,046
Mitsubishi Coal Mining Co., Ltd	Yubari-shi, Hokkaido	940
	Takashima-machi, Nagasaki	671
Taiheiyo Coal Mining Co., Ltd	Kushiro-shi, Hokkaido	2,321
Matsushima Coal Mining Co., Ltd	Sotome-machi, Nagasaki	1,156
Hokutan Yubari Coal Mining Co., Ltd	Yubari-shi, Hokkaido	1,143
Sumitomo Sekitan Akabira Coal Mining Co. Ltd	Akabira-shi, Hokkaido	1,133
Hokutan Horonai Coal Mining Co., Ltd	Mikasa-shi, Hokkaido	1,043
Sorachi Coal Mining Co., Ltd	Utashinai-shi, Hokkaido	938
Hokutan Mayachi Coal Mining Co., Ltd	Yubari-shi, Hokkaido	536
Total		16,994

Of the total coal produced in FY 1979, about 43% was coking coal and 57% was steam coal. By district, about 61% of the total output was in Hokkaido and 39% was in Kyushu. By method of mine development, about 95% was from underground

mines and about 5% was from open-cut mines. About 73.6% of the total production was mined from depths of over 500 meters from the pit mouth. By mining method, 73.6% was by longwall, 5.1% by open cut, 3.8% by hydraulic, 2.5% by room-and-pillar, and 15% by other methods.

The Japanese coal mining industry employed 18,816 mine workers at the end of March 1980. About 65% of the coal miners were working in the Hokkaido area. The annual working day of the Japanese coal miner remained at about 296 days in FY 1979 and labor productivity was 76.8 tons per month of coal per miner in FY 1979 compared with 74.6 tons per month per miner in FY 1978.

During 1980, Japan imported 68,277,000 tons of coal to meet the 88-million-ton demand. To meet this demand, 1,124,000 tons of anthracite was imported mainly from China (39%), Vietnam (28%), the Republic of South Africa (14%), and North Korea (8%); 5,109,000 tons of steam coal was imported mainly from Australia (67%), China (12%), and the United States (7%); and 62,044,000 tons of coking coal was imported principally from Australia (42%), the United States (31%), Canada (17%), and the Republic of South Africa (4.5%). Japan adopted a quantitative allocation system to import coal from overseas, and no tariffs were imposed on coal imports.

Japan's coal demand by consuming sector and by source of coal for 1979-80 was summarized as follows, in thousand tons:

	1979	1980
Manufacturing:		
Coke	4,195	4,309
Domestic	1,461	1,450
Imported	2,734	2,859
Iron and steel	57,688	64,123
Domestic	5,220	5,461
Imported	52,468	58,662
Cement, ceramics, other	3,372	8,148
Domestic	1,738	2,868
Imported	1,994	5,280
Utilities:		
Electric power	7,142	8,603
Domestic	6,872	7,712
Imported	270	891
Gas	1,591	1,604
Domestic	842	825
Imported	749	779
Other	1,233	1,504
Domestic	1,207	1,461
Imported	26	43

According to Japan's long-term energy supply and demand forecast, coal imports are expected to play an important role as an alternative source of the Japanese energy requirements during the next 10 to 15 years. Japan's coal imports are expected to reach 101 million tons (of which 22 million tons is steam coal) by FY 1985 and 143.5 million tons (of which 53.5 million tons is steam coal) by FY 1990, while domestic coal production is expected to remain at the 20-million-ton level through FY 1990.

In an effort to convert energy sources from oil to coal, the Natural Resources and Energy Agency of Japan was planning to construct a coal complex at Sakito in Nagasaki Prefecture and another at Tomakomai in Hokkaido. Each complex would have a coal center equipped with a transportation system, stockpile facilities, and coal cinder disposal facilities capable of handling 7.5 million tons and storing up to 1.25 million tons of coal per year. Each complex would have a harbor berth capable of handling up to 100,000-ton coal carriers. The construction work was expected to start in FY 1981. The total cost of the construction was estimated at about $381 million, and would be financed by the Japan Development Bank with low-interest loans.

In line with the Japanese long-term energy supply forecast, Japan was actively securing overseas coal either through signing of a long-term contract or participating in the actual development and exploitation of foreign coal resources, particularly in Australia, Canada, and China.

During 1980, Japan signed numerous agreements or contracts with Australia and Canada. Important contracts or agreements were summarized as follows:

Date	Buyer	Supplier	Terms of delivery	Remarks
February 1980	8 major steel companies led by Nippon Steel Corp.	Central Queensland Coal Association, Australia.	9.6 million tons for an unspecified 8-year period.	Coking coal from the Norwick Park coal mine.
April 1980	C. Itoh for Japanese steel mills.	MIM Holdings, Ltd., Australia.	15 million tons, 1984-98.	Coking coal from Collinsville Mine (prices would be $52 to $55 per ton).
July 1980	Onoda Cement Co	Australian Associated Resources, Ltd., a subsidiary of CSR, Ltd., Australia.	2 million tons, 1981-80.	Anthracite from Yarrabee Mine in Central Queensland.
July 1980	Mitsubishi Mining and Cement Corp.	Warkworth Association, Australia.	5.5 million tons, 1981-91.	Steam coal from Warkworth Mine in New South Wales.
August 1980	6 Japanese steel mills led by Nippon K.K.	Crows Nest Resources, Ltd., a subsidiary of Shell Canada Resources, Ltd., Canada.	15 million tons, 1983-97.	Coking coal from Line Creek coal mine.
August 1980	do	Gregg River Resources, Ltd., a subsidiary of Menalta Coal Co., Ltd., Canada.	31.5 million tons, 1983-97.	Coking coal from a new Gress River coal mine in Alberta.
December 1980	Japanese steel mills (unnamed).	Capricorn Coal Development, Australia.	5 million tons, 1982-91.	Coking coal from German Creek Mine in Central Queensland.
December 1980	do	The Queensland State Government, Australia.	47 million tons for an unspecified 14-year period.	Coking coal from Riverside Mine in Central Queensland.

In August 1980, a joint venture agreement was reached between four Japanese companies and the New South Wales Electricity Commission (a state agency) of Australia to develop the Birdsrock steam coal mine in New South Wales. Steam coal production was expected to start in 1984 at an annual rate of about 1 to 3 million tons. During 1984-90, about 70% of the output was expected to be shipped annually to the Japanese utilities, which include the Hokkaido Electric Power Co. The Electricity Commission would hold 51% of the mining rights, and the remainder was to be jointly held by the Japanese group (Taiheiyo Coal Development Co. 25%, Japan Coal Development Co. 14%, and Mitsui Co. and C. Itoh Co. 5% each).

An agreement was also reached in August 1980 between Mitsui Mining Co. and the Chinese Government to develop the Si Xiong Kou Mine and to expand the Xiao Kou Mine, both in the Da Dong Coalfields of Shanxi Province. The Si Xiong Kou Mine was expected to produce about 4 million tons of steam coal annually beginning in 1985, while the Xiao Kou Mine would be expanded from an annual output of 600,000 to 1.2 million tons in a 2- or 3-year period. Mitsui Mining reportedly planned to form a consortium to finance and develop China's coal mines in Shanxi Province.

In September 1980, the Export-Import Bank of Japan signed an agreement with the Bank of China to extend four loans totaling about $200 million for the financing of four coal projects. The projects included development of Qianjiaying coking coal deposits in Hebei Province and the steam coal mines at Sitaigou, Zhenchengdi, and Malan in Shanxi Province. After completion of the projects, Japan was expected to import about 10 million tons of coal annually from China starting in 1985.

For the past 7 years, Mitsui Mining has been involved in a research program on coal liquefaction called the Solvent Refined Coal (SRC) process. In 1974, the Mitsui group signed a joint SRC research contract with Gulf Oil Corp. of the United States, which also signed a similar contract with Ruhr Kohle AG of the Federal Republic of Germany. The trilateral group planned to build a coal liquefaction pilot plant in West Virginia (United States) by 1983-85.

In December 1980, an agreement was signed between the Japanese companies and the Victoria State Government of Australia to build a coal liquefaction pilot plant with a daily capacity of 50 tons (brown coal used) in Victoria. The Japanese companies involved in the project were the Mitsui

group and a new coal liquefaction consortium called Nippon Brown Coal Liquefaction Co. (NBCL) comprised of Kobe Steel, Ltd.; Mitsubishi Chemical Industries Ltd.; Nissho Iwai Corp.; Idemitsu Kosan Co.; and Asia Oil Co. The project was promoted as a national project of the Japanese and Australian Federal Governments. MITI would seek an appropriation of about $27 million in FY 1981 to assist in the financing of the plant. Under the agreement, the Victoria State Government would supply the brown coal free of charge to the pilot plant, and the Japanese firm would build the plant by the end of March 1982. The pilot plant was expected to be operational in 1983. If commercial operation proved to be feasible, then a 5,000-ton-per-day verification plant would be built in the 1986-87 period and a 30,000-ton-per-day commercial plant would be built in the 1988-89 period by NBCL.

Petroleum and Natural Gas.—Domestic production of crude oil continued to decline and remained insignificant, accounting for only 0.13% of Japan's primary energy supply and 0.2% of Japan's total crude oil supply in FY 1979. During 1980, Japan imported 256.8 million kiloliters, or 4.4 million barrels per day of crude oil (including natural gas liquids but excluding petroleum products), to meet about 99.8% of its crude oil requirements. However, Japan's crude oil imports in 1980 represented an 8.4% decline from that of 1979 and was the lowest since 1972 (4.1 million barrels per day). It also represented the first significant configuration in change of the Japanese energy consumption pattern (shifting from oil to other energy sources such as coal or LNG) as a result of Government energy-saving measures and promotion of alternative energy resources development.

In 1980, Japan remained the world's second largest petroleum importing country. The principal sources of Japan's crude oil imports were the Middle East region, (73.2% of the total imports) led by Saudi Arabia (31.6%) and the United Arab Emirates (13.6%), and the Asian region (23.4%) led by Indonesia (14.3%). Because of the Iranian Revolution and the Iran-Iraq war, Japan's crude oil imports supplied by Iran, the Neutral Zone, Oman, Kuwait, and Qatar were substantially reduced in 1980. On the other hand, the Japanese crude oil imported from Latin America and Africa increased dramatically in 1980. Crude oil imported from Venezuela increased about fivefold from 8,000 barrels per day in 1979 to 38,000 barrels per day in 1980, and imports from Algeria increased from 6,000 barrels per day in 1979 to 28,000 barrels per day in 1980. Algeria, Libya, Venezuela, Mexico, and Ecuador emerged as potentially important overseas suppliers of Japan's crude oil.

Crude oil supplied by major international oil companies declined from 56.4% of total crude imports in 1979 to only 44.6% in 1980. The share of imports supplied by oil-producing countries through direct deals and a government-to-government basis increased substantially from 31.7% of the total crude imports in 1979 to 44.9% in 1980.

To secure stable supplies and to diversify crude oil supply sources following a restructuring of its crude oil supplies, Japan signed a 10-year crude oil contract with Mexico on December 11, 1979, on a government-to-government basis, with an initial import volume of 25,000 barrels per day, and was expected to reach 100,000 barrels per day by December 1980. In mid-1980, Japan asked Mexico to increase its crude oil supplies to Japan from 100,000 barrels to 200,000 barrels per day in 1981 and to 300,000 barrels per day in 1982. However, no agreement was reached by yearend 1980.

Japan signed two contracts with China on May 29, 1980, for exploration and development of oil resources in Bo Hai Bay in China. The first contract covers 14,100 square kilometers in southern Bo Hai and 11,400 square kilometers in western Bo Hai. The second contract covers the Chengbei block in the deeper areas of western Bo Hai. The total cost of exploration and development for the two areas was estimated at $1.2 billion, of which Japan was expected to pay $210 million for the exploration and the remaining $1 billion was to be shared by Japan and China in a 49:51 ratio. Japan was expected to import from China 42.5% of the output for 15 years beginning in 1982.

In August 1980, Japan, represented by the Japan National Oil Corp. and a group of Canadian private companies represented by Dome Petroleum, Ltd., signed an agreement to jointly develop oil deposits covering 154,440 square miles in Canada's Beaufort Sea in the Arctic. Japan would provide a 400-million Canadian dollar loan to the Canadian companies for exploration and development. The loan was to be repaid by Dome Petroleum in the form of crude oil to be developed. The production was expected to start in 1985 with an initial output level of 100,000 barrels of oil per day.

During 1980, three overseas oil development projects that were undertaken independently started oil production: Mitsubishi Petroleum Development Co., Ltd., in Baliste Field (a Baudroie concession) off the coast of Gabon; the Egyptian Petroleum Development Co., Ltd., in West Baker Field onshore the Gulf of Suez; and Sumitomo Petroleum Development Co., Ltd., in Sahmah Field, in Oman. Japan was to import oil from these areas under production-sharing contracts.

Japan's domestic production of natural gas was about 2,200 million cubic meters in 1980. About 98% of the output was from natural gasfields and 2% was from oilfields and coalfields. The total output of natural gas contributed only 0.6% of Japan's primary energy supply. Japan imported about 16.8 million tons of LNG in 1980 for consumption by Japan's electric utilities (76.9%), city gas companies (19.5%), and manufacturing (3.6%). Japan's LNG imports, which accounted for about 6% of its primary energy supply, was secured normally by a 20-year contract with foreign governments participating in the LNG projects. During 1980, the major suppliers of Japan's LNG imports were Indonesia, 8.5 million tons; Brunei, 5.5 million tons; Abu Dhabi, 1.9 million tons; and the United States (Alaska), about 859,000 tons. Other future overseas suppliers were Malaysia (Sarawak), Australia, Canada, and the Soviet Union.

On October 27, 1980, a group of five Japanese companies comprised of the Nissho-Iwai Corp., Chubu Electric, Kyushu Electric, Osaka Gas, and Toho Gas reached an agreement with Canada's Dome Petroleum, Ltd., for the purchase of 400 million cubic feet per day of natural gas over a 20-year period starting in 1985. This long-term contract, valued at about $20 billion, would be the first sale of Canadian natural gas in any form to any foreign country other than the United States.

In late 1980, after a series of negotiations, an agreement was reached for the Soviet Union to supply 5 billion cubic meters of natural gas or 3 million tons of LNG per year to Japan over a 20-year period beginning in or after 1986. The natural gas would be produced from the areas offshore northeast of Sakhalin (a Soviet island, north of Japan), where vast natural gas reserves have been confirmed by Sakhalin Oil Development Corp.

Uranium.—In September 1980, the Japan-Australia Uranium Resources Development Co. (JAURD) signed an agreement with Energy Resources of Australia (ERA) to invest 41 million Australian dollars on a 10.1% equity participation in ERA and to purchase about 1,000 short tons per year of U_3O_8 over a 15-year period starting in 1982. Under the agreement, the Japanese firms have the option to double their purchases of U_3O_8 to 2,000 short tons per year, beginning in 1990. JAURD was established on September 12, 1980, with an equity of $18 million, which was held by Kansai Electric Power Co. (50%), Kyushu Electric Power Co. (25%), Shikoku Electric Power Co. (15%), and C. Itoh Co. (10%). ERA planned to develop the Ranger uranium mine with proven uranium ore reserves of 120,000 short tons of U_3O_8 and start production at an annual rate of 3,300 short tons of U_3O_8 in 1982. The 400-million-Australian-dollar project would be financed mostly by borrowing from abroad. JAURD, in addition to equity participation, planned to extend a $146 million U.S. loan to ERA from Japan's Export-Import Bank and other domestic financial institutions to help the project.[15]

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[1]Economist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Japanese yen (Y) to U.S. dollars at the rate of Y219.14=US$1.00 for 1979, and Y226.74=US$1.00 for 1980.

[3]Business Week. Apr. 13, 1981, p. 65.

[4]Japan Metal Journal. V. 10, No. 16, Apr. 21, 1980, p. 2.

[5]American Metal Market. V. 88, No. 224, Dec. 18, 1980, pp. 1, 20. Metal Bulletin. Dec. 23, 1980, p. 17.

[6]The Japan Iron and Steel Federation. The Steel Industry of Japan. 1981, p. 19.

[7]U.S. Embassy, Tokyo. Department of State Telegram 15750, Sept. 5, 1980.

[8]Metal Mining Agency of Japan. Mining Activities of Japan. 1980, p. 27.

[9]American Metal Market. V. 88. No. 223, Dec. 17, 1980, p. 1.

[10]Roskill's Letter From Japan (London). No. 50, June 1980, pp. 17-18. Metal Bulletin Monthly. June 1980, p. 50.

[11]Japan Chemical Week (Tokyo). V. 21, No. 1063, September 1980, p. 1.

[12]The Japan Economic Journal. 1981 Industrial Review of Japan. P. 127.

[13]The British Sulphur Corp., Ltd. Phosphorus and Potassium. No. 109, September and October 1980, pp. 10, 17.

[14]Focus Japan (Tokyo). Japan's Energy Situation. V. 7, No. 12, December 1980.

[15]U.S. Embassy, Tokyo. Department of State Airgram A-251, Nov. 6, 1980.

The Mineral Industry of Kenya

By George A. Morgan[1]

In 1980, the growth of the mining and quarrying sector of Kenya's economy remained relatively unchanged. Although the real gross domestic product (GDP) was up almost 2.4% at $4.2 billion,[2] the mining and quarrying sector again accounted for only about 0.25% of GDP, or $10.7 million. The economy was very vulnerable to energy costs as the country had to import 88% of its total energy for consumption. Imports were up because of a relaxation of the advance import deposit requirement, and a trade deficit of $1,116 million was experienced. The balance of payments reached a record deficit of $880 million. Total energy consumption increased 3.5%, and imported crude petroleum cost $678 million, or about 53% of total export earnings, including petroleum product exports.[3]

The country attempted to expand its energy base which was heavily reliant upon imports. Nearly 18% of its electricity requirements were imported from Uganda in 1980. Both hydroelectric and thermal generating capacity were being increased. A process was implemented to make charcoal from coffee husks, and two alcohol plants using cassava as a raw material were expected to produce the equivalent of 13% of total motor fuel consumed. A geothermal electric plant was to be commissioned in 1981 at Olkaria.

Assessment of the nation's nonfuel mineral resources was undertaken by the Mines and Geological Department (MGD) of the Ministry of Environment and Natural Resources. Geological, geophysical, and geochemical work continued in western and southeastern Kenya following completion of an airborne geophysical survey. The MGD and the Institute of Geological Sciences of the United Kingdom agreed to conduct a 4-year joint geological mapping and mineral exploration program in north-central Kenya. Another agreement was signed with the Finnish Geological Survey for a joint industrial mineral assessment program. The assessment would be countrywide, with the object of initiating mining and processing of deposits, as well as providing specialized services to the private sector.

PRODUCTION AND TRADE

The principal mineral commodities produced continued to be soda ash and fluorspar. Capacity to produce barite was increased with the installation of updated processing facilities because demand was up for drilling muds. The possibility of further expansion of barite production from deposits in Coast Province was considered. Most other mineral production was on a low-volume basis, with local markets predominating as the primary users. Cement capacity was increased as demand was up in the major cities. Negotiations were concluded for the establishment of a fertilizer facility at Mombasa. Imported ammonia and phosphoric acid would be feed material to the enterprise. Government and quasi-Government institutions approved 110 projects in 1980, valued at $45 million. However, these were aimed primarily at the manufacturing and agricultural sectors. Additional funds were provided to the cement industry for increasing capacity, while upgrading of the railroad was under way to satisfy new

haulage requirements.

Total freight handled at the Port of Mombasa was up 20% to 7.4 million tons. The major portion of Kenya's imports was from the European Communities (EC) and the Near East. Exports were predominately to the EC and Africa. Exports of soda ash, fluorspar, and cement were valued at $56 million in 1980, while exports of refined petroleum products were valued at almost $400 million.

Table 1.—Kenya: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Beryl, gross weight	1	--	--	(2)	(2)
Gold, mine output, metal content troy ounces	37	135	205	e200	125
Iron and steel:					
Iron ore:					
Gross weight	20,784	16,000	20,129	20,000	14,567
Iron content[e]	12,470	9,600	12,077	12,000	9,469
Crude steel[e]	10,000	10,000	10,000	10,000	10,000
Lead, mine output, metal content[e]	480	--	--	--	--
Silver, mine output, metal content troy ounces	118	--	--	--	--
NONMETALS					
Barite	359	429	298	e300	6,647
Cement, hydraulic	986,874	1,144,429	1,124,690	850,661	1,271,874
Clays: Kaolin	2	495	1,514	e1,500	1,487
Corundum	15	--	(2)	e(2)	(2)
Diatomite	2,668	2,441	1,690	1,266	1,677
Feldspar	1,115	1,869	949	e1,000	387
Fluorspar	75,027	124,000	106,564	77,104	93,378
Gem stones, precious and semiprecious:					
Aquamarine kilograms	3	10	275	NA	35
Garnet[3] do	126	160	274	NA	237
Ruby do	810	532	316	NA	414
Sapphire do	(2)	4	1	NA	148
Tourmaline do	20	23	23	NA	39
Gypsum and anhydrite	78,020	25,999	e30,000	30,000	30,000
Lime	30,059	77,826	e50,000	27,000	26,025
Magnesite	3	3,575	e4,000	e4,000	1
Meerschaum	51	--	--	--	--
Phosphatic materials: Guano	219	55	19,943	NA	--
Salt:					
Crude	49,906	39,932	19,514	21,846	26,966
Refined	14,250	12,300	e12,000	e12,000	20,050
Sodium compounds, n.e.s.:					
Soda, crushed, raw	3,628	2,293	114	NA	1,530
Soda ash	108,763	109,444	152,522	223,845	203,768
Stone, sand and gravel:					
Calcareous:					
Calcite	NA	600	e600	NA	--
Coral (for cement manufacture)[e]	950,000	950,000	950,000	NA	(4)
Kunkur (for cement manufacture)	176,798	44,914	111,647	NA	121,460
Limestone (for cement manufacture)	193,157	50,197	e50,000	NA	41,540,777
Sand	16,994	17,665	23,758	NA	5960
Shale	e200,000	e825,000	257,402	NA	295,183
Talc (pyrophyllite)	--	270	--	--	--
Vermiculite	3,587	4,320	1,863	2,260	2,558
Wollastonite	120	300	100	NA	--
MINERAL FUELS AND RELATED MATERIALS					
Carbon dioxide, natural	2,147	1,960	2,243	NA	3,014
Petroleum refinery products:					
Gasoline, motor thousand 42-gallon barrels	3,091	3,112	3,230	4,060	3,629
Jet fuel do	3,046	3,013	3,023	4,209	3,492
Kerosine do	338	--	--	--	--
Distillate fuel oil do	3,654	4,126	4,103	1,211	4,540
Residual fuel oil do	7,504	7,395	7,925	7,574	68,824
Other:					
Asphalt do	--	207	e212	24	188
Liquefied petroleum gas do	213	225	232	186	280
Unspecified do	268	60	e70	461	693
Refinery fuel and losses do	974	781	e809	932	679
Total do	19,088	18,919	19,604	18,657	22,325

[e]Estimated. [p]Preliminary. NA Not available.

[1]Table includes data available through Sept. 15, 1981.

[2]Less than 1/2 unit.

[3]Quality (gem or industrial) not specified.

[4]Coral for cement manufacture apparently has been included with limestone for cement manufacture.

[5]Probably an incomplete figure.

[6]Including some fuel oil described also as unfinished oil.

COMMODITY REVIEW

METALS

Production of metallic minerals in Kenya was virtually nil. About 15,000 tons per year of magnetite was produced, mainly for the cement industry. Production of lead and byproduct silver from Coast Province ceased with the exhaustion of minable material.

NONMETALS

Asbestos.—Asbestos cement products consisting mainly of sheeting material and pipes manufactured from chrysotile asbestos imported from Swaziland and Australia were produced at Bamburi by the Kenya Asbestos Cement Co. No asbestiform minerals of suitable quality to meet accepted standards have been found in Kenya. Tests made on anthophyllite asbestos from local deposits, for example, at Makinyambu, about 180 kilometers northwest of Mombasa, indicated the fiber to be too brittle and difficult to combine with cement.[4]

Barite.—Economically significant occurrences of barite were located in Coast Province at Mrima Hill and Vitengeni. Production at Vitengeni was from the reworking of old lead mine dumps. Mineral Mining Corp. Ltd. was the principal barite producer. Exploration was under way to determine additional resources, while increased output was provided by the installation of a screening and washing plant.

Cement.—Two cement plants were operated in 1980; the Bamburi plant of the Bamburi Cement Co. near Mombasa, with a capacity of 1.25 million tons per year, and the Athi River plant of the East African Cement Co. near Nairobi, with a capacity of 450,000 tons per year. A third plant was being considered for western Kenya, provided sufficient raw materials proved to be available. Overall national consumption was 62,000 tons per month, of which about 32,000 tons was supplied by Bamburi Cement Co. and the remainder by the East African Cement Co. The remaining portion of production, about 530,000 tons in 1980, was exported.

The principal producer continued to experience transportation problems because of a shortage of railroad cars. The shortage has persisted for several years following recently expanded production capacity at the two cement plants in order to meet increased demand. Most of the supply was destined for construction in Nairobi. Approximately 12,000 tons per month of the 32,000 tons per month normally shipped to Nairobi by Bamburi Cement Co. was backlogged. The Kenya Railway was to provide 60 haulage cars per day instead of the 40 being used in order to move the backlogged material and bring daily shipments to more normal levels.

Modifications at the Bamburi plant were planned to utilize coal imported from Swaziland in order to replace oil. A reduction of 50% of production costs was believed achievable as a result of the changeover in energy source. The Commonwealth Development Corp. provided aid to further expand the cement industry.

Diatomite.—A number of deposits of diatomite have been located in the Rift Valley, the most significant being Kariandus and Soysambu near Gilgil. Reserves at Soysambu were 1.5 million tons, of which 0.3 million tons were suitable for the manufacture of filter aids. Production was by the East African Diatomite Industries Ltd. About 1,600 tons of marketable product was obtained from 3,000 tons of mined ore. The diatomite was calcined in a rotary kiln, crushed, and then graded on the basis of particle size. Four grades of filter aid, as well as six filler and insulating grades, were produced.

Fertilizer Materials.—An agreement was made with a Dutch company by National Agricultural Chemicals & Fertilizers of Kenya Ltd. for the design and construction of Kenya's first nitrogen fertilizer project. A previous plan to erect a 54,000-ton-per-year ammonia synthesis plant using naphtha feedstock was abandoned. Capacity of product plants to be included in the fertilizer project at Mombasa include 75,000 tons per year of nitric acid, 99,000 tons per year of combined product calcium ammonium nitrate and nitrophosphate, and 130,000 tons per year of monoammonium and diammonium phosphate. Port facilities would be built to handle imports of ammonia and phosphoric acid. Commissioning of the facility was scheduled for late 1981. Imports have supplied the fertilizer market in Kenya with consumption at only about 25,000 tons per year of contained nitrogen. Supply to the local market has been restricted by Government price controls which prevented sufficient financial return to importers.[5]

Magnesium based fertilizers were produced locally by the Lokhani Group from magnesite and dolomite operations.

Soda Ash.—The Magadi Soda Co., a subsidiary of Imperial Chemical Industries, Inc., of the United Kingdom, produced soda ash at Lake Magadi. Capacity was 250,000 tons per year. Expansion plans called for a total capacity of 500,000 tons per year by 1983. Soda ash (Trona) was dredged and crushed by a pontoon-mounted dredge, which then pumped the material in slurry form via a flexible pipe to a treatment plant at the site. Treatment included washing, screening, dewatering, and calcination to yield a product having a total alkalinity as Na_2CO_3 of 97.4%. Shipment from Lake Magadi was by way of a 146-kilometer branch line to the Kenya-Uganda Railroad at Konza. Warehouses and a deepwater pier for bulk handling of soda ash were owned and operated by Magadi Soda Co. at Kilindini Harbor. The principal recipient countries have been Thailand, Indonesia, Malaysia, and Singapore.

Vermiculite.—Several deposits were worked for vermiculite, with most production exported. Local consumption was used in production of lightweight concrete products and acoustic plaster.

The deposit at Kenze, 200 kilometers east of Nairobi, had reserves of 500,000 tons and was mined opencast. Crude vermiculite, crushed and screened at the mine site, was shipped to Nairobi for use in the building and construction industry. Other small deposits located in the vicinity of Ndolo provided a product with bulk densities of 8.4 to 9.2 pounds per cubic foot upon exfoliation. Output was also shipped to Nairobi.

The Wasini Mine near Lodosoit was the principal vermiculite mining operation. Reserves were not quantified, but were considered substantial. Production was by the Iwatani-Lonata Vermiculite Co. of Kenya, Ltd. Output was geared to specific customer requirements. Reduction in the cost of transportation could lead to substantially increased production levels.

MINERAL FUELS

Petroleum.—Kenya was dependent upon imports of crude oil for the major portion of total energy consumed. Only about 12% of energy consumption was derived internally, all of which was from hydroelectric powerplant generation. About 4% of total energy consumption was in the form of electricity imported from Uganda. The country's sole oil refinery at Mombasa had a throughput of 3,038,000 tons of crude oil in 1980. About 53% of refinery production was used locally, the remainder was exported. Several major oil firms shared an exploration permit for a 12,420-square-kilometer area covering both onshore and continental shelf zones north of Mombasa.

The Mombasa-Nairobi product pipeline, commissioned in February 1978 and operated by Kenya Pipeline Co., had a throughput of 1.5 million cubic meters in 1980, up 7% from 1979. Road tankers were used at Nairobi for further distribution.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Kenyan shillings (K Sh) to U.S. dollars at the rate of K Sh7.56=US$1.00 for 1980.

[3]Central Bureau of Statistics, Ministry of Economic Planning and Development (Nairobi). Economic Survey 1981. May 1981, pp. 212.

[4]Mason, J. E., and F. G. Theuri. Industrial Minerals Development in Kenya, Atlanta, 1980; 4th Industrial Minerals International Congress.

[5]Nitrogen (London). Kenya. No 129, January-February 1981, p. 13.

The Mineral Industry of North Korea

By Edmond Chin[1]

Total expenditure of the 1980 budget of the Democratic People's Republic of Korea was estimated at $10.5 billion. Expenditures for the people's economy (includes basic construction; mining; electricity; metal, chemical, and construction material industry; technical development; and other sectors) was $6.3 billion, or about 60% of the total. The remainder was for social welfare, military, and administration and management. Estimated national income and revenue in 1979 were $9.7 and $9.5 billion, respectively. About 8% of the national income in 1979 was from Provincial governments, an increase of 24% over that in 1978. Revenues of local governments increased by 10.1% in 1979.[2]

In the early 1970's, North Korea began a large-scale modernization program by importing technology primarily for its heavy industrial sectors.[3] Subsequently, with the increase in oil prices and a drop in the nonferrous metals market, a prime foreign currency earner for the country, North Korea became delinquent in debt payments to creditor countries including Austria, the Federal Republic of Germany, France, Japan, Sweden, and the United Kingdom. Because of ballooning debt problems, North Korea was not able to meet interest payments, and in some instances, defaulted on payments. By 1977, North Korea was indebted to at least 17 Western Nations for $1.4 billion and at least $1 billion to its centrally planned economy trading partners. Japan's claim against North Korea alone was nearly 80 billion yen (about $10.4 million). By 1979, however, a debt repayment agreement was reached with Japan, and negotiations and agreements were being conducted or concluded with other creditors.

To stabilize the country's economy, President Kim Il-sung exhorted the country to meet planned targets for national output and to increase industrial productivity. Priorities in 1979 were revised for 1980. Highest priority in 1980 was again given to mining, especially to increase coal output. The second highest priority was given to the transportation sector for improvement and modernization. The third highest was for trade, that is, output of export products was to be given preference over all other industries. Although Government statements on meeting the target of the current second 7-year plan claim fulfillment and overfulfillment, some sectors of the economy continued to stagnate due to economic isolation as a result of its "chuche" (economic self-reliance) policy and a national budget which favors military defense expenditures.

PRODUCTION

Geologically, North Korea has predominantly the best mineralization for commercial exploitation of the Korean Peninsula. The leading mineral commodity produced is coal, mostly anthracite with some lignite.[4] There is, however, no known commercial production of oil and natural gas. The leading metal ore is magnetite, mined mainly from four provinces. North Korea is also a significant producer of lead and zinc in the Orient. Copper, gold, and silver are mined along with lesser quantities of cobalt, chromium, manganese, molybdenum, nickel, and tungsten. Mine production of magnesite is of world significance. Because the country was overextended in redemption of its foreign debts, the Government exhorted the mining and metals sector to fulfill annual targets to gain foreign exchange through export sales. The central Government does not publish minerals and metals production data, and hence no official statistics are available.

Table 1.—North Korea: Estimated production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal ingot, primary	10,000	10,000	10,000	10,000	10,000
Cadmium metal, smelter	r150	r150	r150	r150	150
Copper:					
Mine output, metal content	15,000	15,000	15,000	15,000	15,000
Metal:					
Smelter, primary and secondary	20,000	20,000	20,000	r18,000	18,000
Refined, primary and secondary	25,000	25,000	25,000	r22,000	22,000
Gold, mine output, metal content, troy ounces	160,000	160,000	160,000	160,000	160,000
Iron and steel:					
Iron ore and concentrate, marketable:					
Gross weight, thousand tons	6,660	6,900	7,100	7,400	8,000
Fe content, do.	2,700	2,800	2,900	3,000	3,200
Metal:					
Pig iron[3], do.	r2,600	r2,700	r2,800	r2,900	3,000
Ferroalloys, furnace type unspecified:					
Ferromanganese, do.	40	55	65	65	70
Ferrosilicon, do.	20	23	30	30	30
Other, do.	10	12	15	15	20
Total, do.	70	90	110	110	120
Steel, crude, do.	3,000	r3,100	r3,200	r3,400	3,500
Semimanufactures, do.	2,800	r2,900	r3,000	r3,200	3,300
Lead:					
Mine output, metal content	110,000	110,000	105,000	r100,000	100,000
Metal, primary and secondary	70,000	70,000	75,000	r70,000	70,000
Silver, mine output, metal content, thousand troy ounces	1,600	1,600	1,600	r1,550	1,550
Tungsten, mine output, metal content	2,150	2,150	2,150	2,150	2,200
Zinc:					
Mine output, metal content	r160,000	150,000	r145,000	r145,000	140,000
Metal, primary	135,000	135,000	130,000	r120,000	120,000
NONMETALS					
Barite	120,000	120,000	110,000	110,000	110,000
Cement, hydraulic, thousand tons	7,000	7,000	7,000	8,000	8,000
Fluorspar	30,000	40,000	40,000	40,000	40,000
Graphite	r20,000	r20,000	r20,000	r25,000	25,000
Lime (quicklime, hydrated lime, dead-burned dolomite), thousand tons	340	350	350	380	400

See footnotes at end of table.

Table 1.—North Korea: Estimated production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Magnesite:					
Crude thousand tons	1,500	r1,465	r1,560	r1,825	1,850
Calcined do.	r625	r610	r650	r760	770
Nitrogen, N content of ammonia do.	270	410	450	450	450
Phosphate rock	450,000	500,000	500,000	r550,000	550,000
Pyrite and pyrrhotite (including cuprous), gross weight thousand tons	600	610	620	620	620
Salt, all types	540,000	550,000	560,000	560,000	570,000
Sulfur:					
From pyrite thousand tons	245	250	255	255	255
Byproduct of metallurgy do.	20	12	10	10	10
Total do.	265	262	265	265	265
Talc, soapstone, pyrophyllite	130,000	130,000	r150,000	r160,000	170,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite thousand tons	33,000	34,500	35,000	35,000	36,000
Bituminous do.	7,800	8,300	8,800	8,800	8,800
Lignite do.	200	200	200	200	200
Total do.	41,000	43,000	44,000	44,000	45,000
Coke do.	2,500	r2,500	r2,700	r2,800	2,900

[p]Preliminary. [r]Revised.

[1]Table includes data available through June 16, 1981.

[2]In addition to the commodities listed, a number of other commodities apparently are produced, but available information is inadequate to make reliable estimates of output levels. These include (but are not limited to) antimony, arsenic (in arsenopyrite), asbestos, beryl, bismuth, boracite, chromium, cobalt, columbite, germanium, indium, kaolin (china clay), lithium minerals (lepidolite), manganese ore, mica (phlogopite), molybdenite, monazite, nickel and/or ferronickel, selenium, tellurium, titanium minerals (ilmenite and rutile), zircon, a variety of crude construction materials (including miscellaneous clays, glass sand, building sand, crushed and dimension stone, and gravel), and refined petroleum.

[3]Includes granulated iron.

TRADE

The Government of North Korea does not publish trade transaction data for foreign dissemination. However, North Korea's main trading partners were China, Japan, and the U.S.S.R., not necessarily in that order.[5] The principal mineral commodity trade with China and the U.S.S.R. was believed to be petroleum for North Korea's crude oil refineries. In addition, trade with the U.S.S.R. included imports of plant machinery and equipment for iron and steel production, oil refining, coke, and coal; and exports of steel and nonferrous metals, magnesia clinker, barite, talc, chemicals, and cement.

Shipments to Japan included zinc ore concentrates, lead and zinc metal ingot, pig iron, silver, magnesia clinker, talc, and anthracite. Receipts from Japan included finished products such as transport equipment, general machinery, electrical apparatus, and textiles, as well as less valued imports of steel and aluminum. North Korea also exported nonferrous metals, primarily lead and zinc, to Belgium, Denmark, France, Italy, Singapore, Switzerland, and the United Kingdom. Moreover, trade agreements were negotiated with several countries which included mineral commodities such as cement, zinc, anthracite, manganese, steel, apatite, crude oil, and refractory brick.

North Korea's main trading companies for the mining and metallurgical industries were as follows:

Name	Remarks
Korea Jeil Equipment Import Corp	Equipment for mining iron and steel, nonferrous, and cement industries.
Korea Jei Equipment Import Corp	Equipment for chemical industry.
Korea Jesam Equipment Import Corp	Do.
Korea Machinery Export Corp	Machinery and equipment for mining, metallurgy, and chemical industries.
Korea Machinery Import Corp	Machinery and equipment for mining, metallurgy, and chemical industries; and equipment for radioactive applications.
Korea Mineral Exports and Import Corp.	Solid fuels; metallic and nonmetallic minerals; construction aggregate; gem stones; and insulation, abrasive, and filtering materials.
Korea Ferrous Metals Export and Import Corp.	Pig iron; ferroalloys; steel; and ferrous manufactures and semimanufactures.
Korea Chemicals Export and Import Corp.	Petroleum and refinery products and chemical fertilizer raw materials.
Korea Building Material Export and Import Corp.	Cement and construction materials.
Korea Light Industries Goods Exports and Import Corp.	Jewelry, and gold and silver goods and products.
Korea Daesong Trading Corp	Metallic and nonmetal minerals and ores; ferrous and nonferrous metal products; and gold and silver.
Korea Pyongang and Trading Co. Ltd	Metallic and nonmetallic materials and ores; ferrous and nonferrous metal ingots; metal manufactures; magnesia.
Korea Ponghwa Trading Corp	Minerals, and metal products.
Korea Maibong Trading Corp	Nonmetallic minerals; nonferrous metal ingots; jewelry; gold and silver; and ferrous manufactures.
Korea Manpung Trading Corp	Equipment and raw materials for the chemical industry.
Korea Senbong Trading Corp	Metallic manufactures.

In addition, the committee for the Promotion of International Trade of the Democratic People's Republic of Korea and the Korea Society for Scientific and Technical Exchange with Foreign Companies were trade promotion groups established by the central Government. The principal banks involved with foreign exchange of currencies and transactions and settlements of foreign accounts were the Foreign Trade Bank of the Democratic People's Republic of Korea and the Kumgang Bank.

Table 2.—North Korea: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum metal including alloys, semimanufactures	r1,372	316	All to Saudi Arabia.
Cadmium metal including alloys, all forms	--	83	All to West Germany.
Copper metal including alloys:			
Scrap	3	--	
Unwrought	25	23	All to Belgium-Luxembourg.
Semimanufactures	r60	11	All to Saudi Arabia.
Iron and steel metal:			
Scrap	--	62	Spain 49.
Pig iron	67,180	51,508	Japan 40,096; Hong Kong 7,823; Singapore 3,316.
Ferroalloys	2,956	3,117	U.S.S.R. 2,818; Saudi Arabia 228.
Steel, primary forms	r15,546	35,245	Saudi Arabia 11,747; Indonesia 8,902; Singapore 8,120.
Semimanufactures:			
Bars, rods, angles, shapes, sections	r38,271	39,108	Saudi Arabia 38,965.
Plates and sheets	r14,662	36,929	Japan 27,023; Indonesia 4,496.
Hoop and strip	r16	60	Indonesia 50.
Rails and accessories	--	998	All to Saudi Arabia.
Wire	r714	2,546	Saudi Arabia 2,028; Hong Kong 448.
Tubes, pipes, fittings	r4,245	17,394	All to Saudi Arabia.
Castings and forgings, rough	r1,315	1,498	Saudi Arabia 1,310.
Lead:			
Oxides	683	--	
Metal including alloys:			
Scrap	--	682	West Germany 600; Japan 82.
Unwrought	32,148	27,255	Japan 10,905; West Germany 7,409; France 7,083.
Semimanufactures	r23	4	All to Saudi Arabia.
Mercury 76-pound flasks	1,979	--	
Silver metal, unwrought or wrought value, thousands	$14,779	$34,099	Switzerland $14,770; West Germany $9,188; Italy $6,544.

See footnotes at end of table.

Table 2.—North Korea: Apparent exports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Tin ore and concentrate	4,176	--	
Zinc:			
Ore and concentrate	21,516	64,704	Japan 46,748; Yugoslavia 17,956.
Metal including alloys:			
Unwrought	39,685	49,910	Japan 29,224; Hong Kong 6,879; France 6,566.
Semimanufactures	r247	--	
Other:			
Ash and residue containing nonferrous metals	2,587	4,068	All to Japan.
Base metals including alloys, all forms, n.e.s	10	--	
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	r29	6	All to Saudi Arabia.
Cement	r434,216	256,937	U.S.S.R. 190,000; Saudi Arabia 37,916; Hong Kong 22,021.
Clays and clay products:			
Crude:			
Kaolin	20,559	26,400	Do.
Other	50	101	All to Japan.
Products:			
Refractory	--	754	All to Saudi Arabia.
Nonrefractory	r209	313	Saudi Arabia 310.
Diamond:			
Gem, not set or strung -- value, thousands	r$107	--	
Industrial -- do	--	$43	All to Belgium-Luxembourg.
Feldspar and fluorspar	6,844	3,561	All to Poland.
Fertilizer materials, manufactured:			
Nitrogenous	21,119	26,815	U.S.S.R. 16,614; Sri Lanka 10,200.
Other including mixed	--	2	All to Saudi Arabia.
Graphite, natural	13,247	24,478	Japan 22,456; Austria 1,215.
Gypsum and plasters	--	102	All to Saudi Arabia.
Lime	r10	299	Do.
Magnesite including powder	667,697	757,787	U.S.S.R. 498,021; Poland 121,259; Japan 79,474.
Precious and semiprecious stones, except diamond value, thousands	$3	$12	West Germany $7; Singapore $4.
Pyrite	--	15	All to Saudi Arabia.
Salt	r9	58	Do.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	7,228	11,573	All to Japan.
Worked	r129	172	All to Saudi Arabia.
Gravel and crushed rock	--	3,038	All to Japan.
Quartz and quartzite	2,357	1,565	Japan 1,563.
Talc	54,587	74,546	Japan 52,335; Poland 11,373; United Kingdom 10,738.
Other, crude	6,542	1,000	All to Hungary.
MINERAL FUELS AND RELATED MATERIALS			
Coal, anthracite and bituminous	27,211	56,782	All to Japan.
Petroleum refinery products:			
Kerosine -- 42-gallon barrels	r93	132	All to Saudi Arabia.
Lubricants -- do	r7	147	Do.
Other:			
Liquefied petroleum gas -- do	--	35	Do.
Bitumen and other residues -- do	r448	1,297	Saudi Arabia 1,115.
Bituminous mixtures -- do	r42	418	All to Saudi Arabia.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r16	180	All to Japan.

rRevised.

[1]Owing to the lack of official trade data published by North Korea, this table should not be taken as a complete presentation of North Korea's mineral exports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Data are compiled from available official trade statistics of individual trading partners.

Table 3.—North Korea: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Oxides and hydroxides	1	2	All from Japan.
Metal including alloys:			
Scrap	50	--	
Unwrought	2,271	810	Singapore 751; Japan 59.
Semimanufactures	600	493	Japan 208; West Germany 151; Austria 99.
Antimony metal including alloys, all forms kilograms	[r]203	2,001	Singapore 2,000.
Chromium:			
Chromite	10,000	7,000	All from U.S.S.R.
Oxides and hydroxides	102	70	All from Japan.
Cobalt:			
Oxides and hydroxides	20	25	Singapore 24.
Metal including alloys, all forms	--	2	All from Singapore.
Copper:			
Matte	--	110	All from Saudi Arabia.
Metal including alloys:			
Scrap	--	83	Saudi Arabia 43; Singapore 40.
Unwrought	1,714	--	
Semimanufactures	419	187	Japan 161.
Iron and steel metal:			
Scrap	1,955	--	
Ferroalloys	2,561	5,409	Japan 5,359.
Steel, primary forms	48	--	
Semimanufactures:			
Bars, rods, angles, shapes, sections	[3]8,911	3,351	Austria 1,765; Japan 1,561.
Plates and sheets	[3]12,598	19,776	Japan 14,843; West Germany 4,587.
Hoop and strip	263	117	Japan 107.
Rails and accessories	496	932	All from Japan.
Wire	738	1,049	Japan 1,012.
Tubes, pipes, fittings	1,555	6,833	Japan 5,638; Hungary 1,011.
Lead:			
Ore and concentrate	1,300	--	
Metal including alloys, semimanufactures	--	149	Australia 146.
Magnesium metal including alloys, all forms	60	169	Singapore 153; Japan 12.
Manganese:			
Ore and concentrate	21,000	21,000	All from U.S.S.R.
Oxides	604	252	All from Japan.
Nickel metal including alloys:			
Unwrought	155	82	Japan 60; Singapore 22.
Semimanufactures	54	7	Japan 4; West Germany 3.
Platinum-group metals, unwrought or wrought value, thousands	$7	$49	All from West Germany.
Silver metal, unwrought or wrought do	$2	--	
Tantalum metal including alloys, all forms kilograms	--	15	All from Japan.
Tin:			
Oxides do	300	--	
Metal including alloys:			
Unwrought	230	12	All from Singapore.
Semimanufactures	--	2	Japan 1.
Titanium:			
Oxides	13	56	West Germany 35; Japan 21.
Metal including alloys, all forms	--	2	All from West Germany.
Tungsten ore and concentrate	293	--	
Zinc:			
Ore and concentrate	--	20,419	Australia 10,951; Canada 9,468.[4]
Oxides	18	--	
Metal including alloys:			
Unwrought	20	--	
Semimanufactures	1,219	533	All from Japan.
Other:			
Oxides, hydroxides, peroxides, n.e.s	1	98	Do.
Metals:			
Metalloids	3	1	Do.
Base metals including alloys, all forms, n.e.s	20	--	
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc. kilograms	1,269	--	
Dust and powder of natural and synthetic precious and semiprecious stones do	1	2	All from Japan.
Grinding and polishing wheels and stones	38	12	Japan 10.
Boron materials: Oxide and acid	21	--	

See footnotes at end of table.

Table 3.—North Korea: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Chalk	18	53	All from United Kingdom.
Clays and clay products:			
Crude	5	300	All from Singapore.
Products:			
Refractory	3,074	4,132	Japan 4,082.
Nonrefractory	5	91	Italy 88.
Diamond:			
Gem, not set or strung ____ value, thousands	$20	--	
Industrial ____ do ____	--	$28	All from Japan.
Diatomite and other infusorial earth	--	3	Do.
Fertilizer materials:			
Crude, phosphatic ____ thousand tons	NA	[5]325	Syria 177; Algeria 93; Egypt 55.
Manufactured:			
Nitrogenous	--	100	All from Japan.
Potassic	150,900	83,474	All from U.S.S.R.
Other including mixed	202	--	
Gypsum and plasters	1	--	
Mica, all forms	1	5	All from Japan.
Precious and semiprecious stones except diamond, natural and synthetic ____ value, thousands	$10	$84	France $72; Austria $12.
Salt	317	338	All from Japan.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	5	48	All from Belgium-Luxembourg.
Caustic potash	--	1	All from Japan.
Soda ash	1	2	Do.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	--	30	All from Italy.
Worked	--	175	Italy 167.
Sand	--	4	All from Japan.
Sulfur:			
Elemental	7	4	Do.
Sulfuric acid	3	3	Do.
Other, crude	--	3	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	401	9	Do.
Carbon black	188	544	Do.
Coal, anthracite and bituminous ___ thousand tons	17	15	Do.
Coke ____ do ____	96	186	Poland 94; Japan 92.
Peat and peat briquets	--	12	All from Canada.
Petroleum refinery products:			
Gasoline ____ thousand 42-gallon barrels	97	--	
Kerosine ____ do ____	--	4	Hungary 3.
Residual fuel oil ____ do ____	[r]388	147	All from Singapore.
Lubricants ____ do ____	11	18	Singapore 17.
Other:			
Liquefied petroleum gas ____ do ____	--	([6])	All from France.
Mineral jelly and wax ____ do ____	2	--	
Bitumen and other residues ____ do ____	2	--	

[r]Revised. NA Not available.

[1]Owing to the lack of official trade data published by North Korea, this table should not be taken as a complete presentation of North Korea's mineral imports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Unless otherwise specified, data are compiled from available official trade statistics of individual trading partners.

[3]Partial figure; Japan reports additional exports to North Korea but only in terms of value.

[4]Reported Canadian exports of zinc ore with 4,734 tons metal content.

[5]The British Sulphur Corporation Limited. Statistical Supplement, London.

[6]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Ferrous Metals.—*Iron Ore.*—The main producing areas for iron ore in North Korea are the Provinces of North Hamgyong, South Hwanghae, Kangwon, and South Pyongan. The largest deposit is at Musan which is estimated to contain 1.3 billion tons of magnetite. The Musan Mine has an annual output capacity of 6.5 million tons, and during the second 7-year plan, capacity was to be increased to 10 million tons

annually. The magnetite granules at Musan are described as large and easily separated. The ore dressing plant at Kangdok treats the 40% iron content ore and concentrates it to 59% to 60%. Ore transport to Kangdok is by the electrified Chogjin-Musan Railway and by a slurry pipeline completed in 1975. The Musan Mine is the principal iron ore supplier for Kim Chaek Iron and Steel and is located 98 kilometers from the complex. The iron ore mines at Songnim and Tokyon feed the Hwanghae Steel Refinery complex. Annual mine output at Tokyon was 750,000 tons per year. The major iron ore mines in North Korea were as follows:

Province administrative unit	County	Mine	Remarks
Chongjin City	Musan	Musan	6.5 million tons per year; output for Kim Chaek Iron and Steel.
South Hamgyong	Toksong	Toksong	Undergoing expansion.
Do	Tiwon	Yiwon	
Do	Nochon	Yongwon	
North Hwanghae	Songnim	Songnim	Output for Hwanghae Steel.
South Hwanghae	Chaeryong	Chaeryong	
Do	Unyul	Sohaeri	
Do	Taetan	Taetan	Under development.
Do	Unyul	Unyul	1.2 million tons per year; output for Hwanghae Steel.
North Pyongang	Uiju	Tokyon	750,000 tons per year; output for Hwanghae Steel.

The final-year target for iron ore output for the 6-year plan (1971-77—this plan was extended by 1 year) was 13 million tons per year. In the second 7-year plan (1978-84), the final year target was for a goal of 16 million tons per year.

Iron and Steel.—The Kim Chaek Iron and Steel complex is the largest in North Korea. In addition to 3 or 4 small blast furnaces, the No. 1 and No. 2 blast furnaces at Kim Chaek have an inner volume of 1,000 cubic meters and for No. 3, 1,500 cubic meters. During the 6-year plan (1971-77), a 3-million-ton-per-year continuous sintering furnace was installed; as well as No. 3 and 4 coking ovens and two 100-ton rotary furnaces; and a 1-million-ton-per-year hot-rolling plant (Model 1700 hot roller) was completed with Soviet aid. Under the second 7-year plan, installation of a second slurry pipeline between Musan Mine and the ore dressing plant at Kangdok was proposed; the railway line between Komusan and Musan was to be double tracked; construction of a 400,000-ton-per-year cold-rolling plant was to be completed; and plans for construction of a No. 5 coking oven were reported.

Hwanghae Iron and Steel complex has three 1,000-cubic-meter blast furnaces. Ore from the Unyul Mine is shipped by sea by way of Kumsanpo or by two overland railway routes— Sohaeri-Sugyo/Umpa line and Songnim via the Pyongbu line. A sheet roller was completed in 1963; medium blast furnaces installed in 1964; a 400,000-ton-per-year blooming shop completed in 1964; and the No. 6 open-hearth furnace installed in 1965. During the 6-year plan, the three blast furnaces were enlarged to the present inner volume of 1,000 cubic meters; construction of a granulated iron and reduced lump ore shop was completed; and a sintering plant completed.

North Korea's iron and steel works were as follows:

Name	City	Principal product line
Kim Chaek Iron and Steel.	Chongjin	Pig iron, sponge iron, steel, rolled steel.
Hwanghae Iron and Steel.	Songnim	Pig iron, granulated iron, steel, rolled steel.
Kangson Iron and Steel (includes 13-14 Iron-Works).	Taen	Granulated iron, rolled steel, alloy steel, tool steel, steel wire and rope, seamless steel pipe, castings, blister.
Chongjin Steel Works.	Chongjin	Granulated iron, steel, rolled steel.
Songjin Steel Complex.	Kim Chaek	Rolled steel, alloy steel.
Puryong Metallurgical Works.	Chongjin	Iron alloys, ferrochromium, ferrosilicon.
Pyongyang Steel Factory.	P'yongyang	Cast iron pipe.
Chongjin Cast Iron Pipe Factory.	Chongjin	Cast iron pipe.
Muchon Steel Factory.	Muchon	Castings.

The Pyongyang, Puryong, Chongjin, and Muchon facilities are small casting plants, using open hearths and electric furnaces. In addition, the central Government proposed the construction of an iron works to be located on the lower reaches of the Taedong River and an electric furnace iron works in Sobu.

Other Ferrous Metals.—Nickel was mined from the Pugan area, Chongjin City; manganese in Cholwon County, Kangwon Province; and tungsten from the Kyongsu Mine in Taegung County, South Pyongan Province, and from the Mannyon Mine in Sinpyong County, North Hwanghae Province. Cobalt and molybdenum was also produced, the latter probably as a byproduct of copper mine production.

Nonferrous Metals.—Little information is publicly available on the nonferrous industry in North Korea. Under the second 7-year plan, a production target of 1 million tons per year was set collectively for nonferrous metals, most of which was for lead and zinc, followed by copper.

Copper-lead-zinc.—The most prominent lead-zinc producer in the country is the Komdok Mine in Tanchon County, South Hamgyong Province. In the same Province, lead-zinc is also produced at the Sankok Mine in Kowon County. Other lead-zinc operations include the Kyesong Mine in Chagang Province; Kaun Mine, Muchon, Kangwon Province; and Sungchang Mine in South Pyongan Province.

The country's most significant copper production is from the Huchang Mine in Chagang Province, the Kapsan Mine in Yanggang Province, and the Tanchon Mine in South Hamgyong Province. Other production is from the Hyesan Youth Mine at Haisan City and the Hwapyong Mine in Hwapyong County. Substantial copper mineralization reportedly occurs also in multimetal orefields in South Pyongan and North Hwanghae Provinces.

North Korea's nonferrous smelters were as follows:

Name	City	Product and Remarks
Haeju Smelter	Haeju	Copper and sulfur.
Hungnam Smelter	Hamhung	Electrolytic copper, lead, silver, nickel.
Mumpyong Smelter	Muchon	Copper, electrolytic copper, lead, zinc, chalcopyrite, sulfur.
Nampo Smelter	Nampo	Electrolytic copper, zinc, gold, silver, chalcopyrite, associated fertilizer plants.
Pyongyang Nonferrous Metal Plant	Pyongyang	Electrolytic copper, also refines scrap copper.
Tanchon Smelter	Tanchon	Copper.

The current annual production capacity for lead and zinc is estimated at 200,000 tons and for copper, 100,000 tons. In addition to the primary products, North Korean refineries also recover byproduct molybdenum, and remelt aluminum and tin from scrap or imported material.

Miscellaneous Nonferrous Metals.—According to early source materials, gold production in North Korea has been as high as 31 tons, around 1939. The large gold occurrences are in the Unsan region of North Pyongan Province; other widely scattered occurrences are in North Hwanghae, Kangwon, and South Pyongan Provinces. Nonferrous metal mines reportedly active in the country were as follows:

Commodity	Mine	City and Province
Aluminum (nepheline).	Changsan	Taedong, South Pyongan.
Antimony	Inpyong	Yangdok, South Pyongan.
Gold	Multong	Yonsan, North Hwanghae.
	Suan	Suan, North Hwanghae.
	Sinyon	Sakchu, North Pyongan.
	Taeyudong	Tongchang, North Pyongan.
	Unsan	Unsan, North Pyongan.
Nonferrous, n.e.c.	Hamgyung	Hoechang, South Pyongan.
	Kukok	Ongjin, South Hwanghae.
	Mandok	Hochon, South Hamgyong.
	Nanchon	Pyongsan, South Hwanghae.
	Ongjin	Ongjin, South Hwanghae.
	Pupo	Kangyong, South Hwanghae.
	Pyogsan	Pyongsan, North Hwanghae.
	Sinpung	Kumhwa, Kangwon.
	Sinwon	Sinwon, South Hwanghae.
	Tongbang	Changgang, Chagang.
	Unhung	Unhung, Yanggang.

Most of the country's requirement for tin and aluminum is met by imports. In the 1950's, an aluminum smelter utilizing nepheline was built at Yongampo. However, no information is currently available regarding the status of this smelter.

NONMETALLIC MINERALS

Cement.—By the end of 1978, the Government announced that the annual production capacity for cement had reached 8 million tons. By the end of 1984, annual capacity was expected to be 12 to 13 million tons. Because of the large demand for cement as a result of domestic construction and military requirements, and as an exportable item to earn foreign exhange, North Korea was expected to make a considerable effort to attain the 1984 target. North Korea's annual cement production capacity, estimated by plant, was as follows, in thousand tons:

Plant	City and Province	Capacity
Chonnaeri	Muchon, Kangwon	1,000
Haeju	Haeju, South Hwanghae.	850
Comusan	Chongjin, North Hamgyong.	810
Kujang	Kujang, North Pyongan.	200
Madong	Pongsan, North Hwanghae.	1,350
Puraesan	Kowon, South Hamgyong.	500
Sunchon	Sunchon, South Pyongan.	3,000
Sunghori	Pyongyang	650
All other plants (30).		1,140
Total		9,500

In addition to the major product, portland cement, some plants produced white cement, clinker, slake lime, and fireproofing materials. North Korea exports cement under the "Deer" brand name. Partial specifications of this brand are SO_2 2.5%; MgO 4.5%; fineness, 2,250 cubic centimeters per gram; refractory, 3,400 pounds per square inch after 7 days.

Chemical Fertilizer.—The largest chemical fertilizer producer in North Korea is the Hungnam Combined Fertilizer Enterprise. This facility produces over one-third of the country's total output of fertilizer. North Korea has abundant hydropower, limestone, and apatite, but lacks oil and natural gas for production of nitrogenous fertilizers. Additionally, the quality of domestic apatite reportedly is poor, and the industry has imported up to 1.2 million tons of phosphate rock for feed solely to the Haeju Phosphate Fertilizer Plant. North Korea's chemical fertilizer plants are as follows:

Name	City	Product line and remarks
Aoji Chemical	Undok	Ammonium bicarbonate; phosphate fertilizers; methanol; 50,000-ton-per-year ammonia capacity and coal gasification facilities under construction.
Chongjin Lime Nitrogen Fertilizer Plant	Chongjin	Lime; nitrogen.
Chongnyon Combined Chemical Enterprise	Anju	Urea fertilizer.
Chongsu Chemical Plant	Chongsu	Lime; nitrogen; deliquescent phosphate fertilizer; phosphate fertilizer; microelement nutrients.
Haeju Phosphate Fertilizer Plant	Haeju	Deliquescent phosphate fertilizer.
Haeju Smelter	Haeju	Phosphate fertilizer.
Huichon Lime Nitrogen Fertilizer Plant	Huichon	Lime; nitrogen.
Hungnam Combined Fertilizer Enterprise	Hamhung	Ammonium sulfate; ammonium nitrate; lime; superphosphate of lime; microelement nutrients; urea; agricultural chemicals; 1-million-ton-per-year capacity of nitrogenous fertilizers; 100,000-ton-per-year capacity of calcium superphosphate fertilizer.
Hungnam Smelter	Hamhung	Phosphate fertilizer.
Hwanghae Combined Iron Works	Songnim	Ammonium sulfate.
Kaechon Lime Nitrogen Fertilizer Plant	Kaechon	Lime; nitrogen.
Kanggye Microbe Fertilizer Plant	Kanggye	Nitrogen fixation nutrients.
Kimchaek Combined Iron Works	Chongjin	Ammonium sulfate.
Munpyong Smelter	Muchon	Phosphate fertilizer; microelement nutrients.
Nampo Smelter	Nampo	
Sandung Chemical Plant	Kangdon	Microelement nutrients.
Sinchon Lime Nirogen Fertilizer Plant	Sinchon	Lime; nitrogen.
Sinwon Calcium Hydroxide Plant	Sinwon	Lime.

Under the last economic plan, the target for the final year was 3 million tons of chemical fertilizers, of which 1 million tons was for phosphatic fertilizers. Under the current plan, annual production for total fertilizer output was to be 5 million tons by 1984.

Magnesite.—North Korea is believed to have one of the world's largest magnesite operations. Reserves at Yongyang Mine in Tanchon County in South Hamgyong Province are estimated at 3.6 billion tons. Magnesite ore is transported by the electrified Hamnan railway line to the Tanchon Magnesia Plant in Tanchon and to the Songjin Fireproof Materials Plant in Kim Chaek, where the magnesite is calcined into clinker. Refractory bricks and products are manufactured by the Songjin Plant and by Kangdok Fireproof Material Plant in Chongjin. In 1977, a large rotary oven was installed at the Songjim Plant; and in 1979, two 110-meter rotary ovens were installed at the Tanchon Plant. Construction of a large magnesite ore dressing plant was proposed for construction during the second 7-year plan.

Other Nonmetals.—In addition to aggregates and dolomite, active nonmetal mining operations included the following:

Commodity	Mine	City and Province
Clay (refractory)	Saenggiryong	Chongjin, North Hamgyong.
Graphite	Pakchon	Pakchon, North Pyongan.
	Tongbang	Changgang, Chagang.
Limestone	Munmuri	Sohung, North Hwanghae.
	Puraesan	Kowon, South Hamgyong.
	Sindok	Sinwon, South Hwanghae.
	Songsan	Sunchon, South Pyongan.
	Tongan	Tanchon, South Hamgyong.
	Unsan	Sunchan, South Pyongan.
Marble	Panmun	Kaesong.
Phosphate (apatite)	Nagyon	Changyon, South Hwanghae.
	Pongman	Pyonggang, Kangwon.
	Pungnyon	Tonchang, North Pyongan.
	Pungyon	Sakju, North Pyongan.
	Sinpung	Pyonggang, Kangwon.
	Yongyu	Pyongwon, South Pyongan.
Silica	Monggumpo	Changyon, South Hwanghae.
	Myonggan	Myonggan, North Hamgyong.

Nampo Glass Factory, the largest user of domestic silica, is the leading producer of flat glass and other glass in the country. Barite and talc are also locally mined, parts of which are domestically consumed, as well as exported.

FUELS

Anthracite.—Total reserves in North Korea were estimated at 8 billion tons in 1963, but as a result of exploration, the estimated reserves should exceed this amount. The ratio of anthracite and lignite is about 2 to 1. Up to 90% of the anthracite is fines, while most of the soft coal is lignite. Deposits of bituminous coal are small. Over 90% of the anthracite deposits occur widely in South Pyongan Province on the west coast while over 90% of the lignite occurs throughout North Hamgyong on the east coast. North Korea's coalfields are characterized as follows:

District	Coalfield and Province	Principal mines
West coast	Northern, South Pyongan.	Choyang, Hyongbong Shinchang, Tokchon, Yongmun, Yongtung.
	Southern, Pyongan and environs.	Hukyong, Kandgong, Kampo, Samsin.
	Western, South Pyongan and North Hwanghae.	Anju, Sariwon.
East coast	North Hamgyong.	Aoji, Hamyon, Kokonwon, Onsong.
	Kowon, South Hamgyong.	Kooham, Yongan Chonnae, Kowon.

The Northern Coalfield is the largest anthracite deposit in the country. The Kowon Coalfield on the east coast is based on anthracite occurrences, as is the Hyesan Mine in Yanggang Province. About 70% of the lignite is contained in the coalfields of North Hamgyong Province. Other lignite production is from Naju, Kocham, Sariwon, Tongchon (in Kangwon Province), and Yongam.

During the 6-year plan, the central Government announced that the country's coal production capacity reached 50 million tons in late August 1975. Under the second 7-year plan, the target was to increase production to 70 to 80 million tons per year by 1984.

Petroleum and Natural Gas.—There is no commercial production of oil and natural gas in North Korea. According to the Ministry of Resource Development, there are oil deposits in the lower estuary of the Chongchon River Basin. Furthermore, North Korea reportedly recovered very small quantities from offshore oil deposits in the Yellow Sea but no confirmation of the occurrence is available.

All the country's requirements for petroleum are met by imports. The Sungni Chemical Plant is a crude petroleum refinery located in Unggi, completed during the middle of the 6-year plan. The 2-million-ton-per-year refinery uses light crude oil supplied by the U.S.S.R. The crude is unloaded at the Najin port and is transported about 4 kilometers by pipeline to the Sungni refinery.

With Chinese aid, construction of a second petroleum refinery was completed in 1978 at Paengma-ri, Pihyon County, in North Pyongan Province. This refinery, Ponghwa Chemical Plant, uses Chinese crude oil transported by two pipelines installed between China and Sinuihi.

North Korea also receives crude oil from Algeria and other countries in the Middle East. Aside from the crude refineries, the Chongnyon Combined Chemical Enterprise, a petrochemical plant, was completed in 1976. Another petrochemical plant was proposed for Nampo, but construction was reportedly not yet under way.

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[1]Physical scientist, Branch of Foreign Data.

[2]Supreme People's Assembly Approves 1980 Budget. Vantage Point (Seoul). V. 3, No. 4, April 1980, pp. 17-21.

[3]North Korea, Background Notes. U.S. Department of State, July 1980, 7 pp.

[4]Korea (DPR), Mining Annual Review—1980, Min. J., p. 466.

[5]Present State of DPRK Economy. Foreign Trade, Japanese External Trade Organization, v. 97-115, March 1979, pp. 24-92.

The Mineral Industry of the Republic of Korea

By Edmond Chin[1]

After the assassination of President Park Chung-Lee on the night of October 26, 1979, Premier Choi Kyu-hah became acting President and was subsequently elected 10th President on December 6, 1979, by the National Conference for Unification. In his inaugural address, Choi defined his Presidency as a "crisis management" administration[2] and announced plans to hold elections as soon as possible following the enactment of a new constitution. In August 1980, General Chun Doo-huan was elected President under the terms of the Yushin Constitution ratified in 1972.

Under the current 5-year economic development plan, the country's gross national product (GNP) was to grow at a projected annual rate of 9.2% between 1977 and 1981. In addition to the drastic political changes in 1979-80, the Korean economy was buffeted with inflation, increasing foreign deficit, weak domestic demand for goods, low employment, and a poor rice harvest. GNP in current prices[3] was $57.6 billion in 1980 compared with $60.1 billion in 1979. In constant (1975) prices, GNP in 1980 was $28.8 billion ($30.5 billion in 1979), a decline in real terms of 5.7%.[4] Real growth in GNP in 1978 and 1979 were 11.6% and 6.4%, respectively. By sectors, the largest inputs to GNP in current dollars were manufacturing, $16.9 billion; wholesale and retail trade, $9.8 billion; agriculture and fishing, $9.7 billion; construction, $5.4 billion; and transport, storage, and communication, $3.6 billion. The mining and quarrying sector provided only $715 million to GNP in 1980.

Total personal income decreased from $46.2 billion in 1979 to $44.1 billion in 1980, while the average index (1975=100) for labor productivity increased from 151.5 in 1979 to 165.1 in 1980, industrial production declined from 213.5 to 211.4, respectively. The index for wholesale prices increased from 162.1 in 1979 to 225.2 in 1980, while the consumer price index went from 171.9 to 221.2, and the average industrial wage increased from 305.5 to 384.9 in 1980. The labor force increased by 308,000 to 14.5 million in 1980. However, the unemployment rate also increased from 3.8% in 1979 to 5.0% in 1980. Employment in the mining sector was estimated at 124,000 in 1980 compared with 111,000 in 1979.

Between 1974 and 1979, the Korean currency (won) was pegged to U.S. currency at the rate of 484 won to $1.00. In January 1980, the Korean currency was devalued by 20% to 580 won and allowed to float with its value determined by special drawing rights and a trade-weighted currency valuation. Between February and May, the won lost ground, and the Bank of Korea posted monthly devaluations. By June, the won reached the 600 mark, and at yearend 1980, the won conversion was 659.90.

Because of the economic slump, the Government planned to stimulate investment by providing incentives and accelerate the implementation of public works projects. Five major areas were selected for policy emphasis: Realizing the country's growth potential; promoting exports and strengthening the balance of payments position; controlling inflation; redressing income inequities and expanding social services; and undertaking institutional reforms for continued growth through greater economic efficiency.[5]

On June 5, 1980, the Government announced short-term policy changes to stimulate the economy that included a 1% to 2% reduction in business loan interest rates, revisions in terms of export financing

loans to Korean manufacturers, restrictions on imports of agricultural commodities other than rice, and a $300 million public works program concentrated in the housing and agricultural development sectors. On September 16, the Government provided a further reduction in bank interest rates and further stimulus to the construction industry. Also, the won was allowed to drop in value to help export performance and to ameliorate the country's balance of payments. In early November, interest rates were lowered further, excise taxes on some consumer durables were cut, and credit was infused into the economy by direct loans to firms and by providing consumer credit to stimulate domestic demand.

On September 25, the Government liberalized regulations governing foreign investments. The principal changes were as follows: New eligible industry projects introduced; minimum permissible investment lowered from $500,000 to $100,000; up to 100% equity allowed for high technology projects or skills that diversify investment sources, contribute to exports, or meet other special conditions; no restriction imposed on withdrawal of investment funds; preferential tax measures; and foreign acquisition of land simplified and rules governing thereof will be enforced in a flexible manner.

In an initial move to relax statutory controls gradually, the Government gave permission for the establishment of a joint venture bank with foreign participation. In another directive, Korean businesses were to divest themselves of speculative land holdings and subsidiary companies. This move would, purportedly, lower the average debt-equity ratio of the industry and permit industry to meet future economic downturns more easily.

To shore up the country's growth potential, the Government proposed plans to improve the domestic industrial structure, stimulate private investment, and promote small- and medium-size industries. Korea has large corporate conglomerates; the 10 largest business groups control 251 subsidiary companies and dispose of assets totaling $22.5 billion. Gross sales by the top 10 conglomerates accounted for 38.4% of the GNP in 1979. The four largest companies each has annual sales of over $3.5 billion. Hyundai Corp., the largest, had sales of $4.6 billion followed by Samsung Co., Daewoo Industries, and Lucky Development Co., in that order.

According to a survey by major Korean business organizations, business operating expenses in 1980 were to increase overall by 60%, principally as a result of increased prices for raw material, and to a lesser extent wages and banking costs. Factors such as higher oil prices (higher utility costs) and devaluation of the won were expected to result in a net profit-to-sales ratio of only 1% to 2%. Past borrowings have lowered the net worth to total assets ratio of Korean enterprises to an average of 21%, and this ratio was expected to deteriorate and increase industry vulnerability to economic slowdowns. Moreover, reduced profits and retained earnings decreased investment capital. A large part of industrial investment funds (42.4%) was for maintenance, replacement, and repair. Although there has been overexpansion in certain sectors of heavy industry, large investments were needed overall for facility modernization and for research and development.

Korean entrepreneurs claimed that the present tax system penalized domestic businesses compared with competitors in Japan and Taiwan. Assuming $17 million in pretax profits and an $8.5 million capital investment, the Federation of Korean Industries estimated that a Korean firm, subjected to a 53% corporate tax rate and with additional surtaxes and charges totaling $3.8 million, has a deficit of $4.3 million. However, a firm in Japan, which is subject to a 40% tax rate and for a firm in Taiwan with a 35% corporate tax rate, in contrast would retain $2.6 million after investment. Moreover, interest costs on borrowings constituted 5% to 9% of each sales dollar. In a survey of 311 firms on the Korean Exchange, total assets rose 37.6% in 1979 while total liabilities were up 39.8%. The Bank of Korea reported that one-third of total industry investments in 1979 were from internal savings and another third was from foreign loans.

In mid-1980, the Government directed the realinement of six industries. Initial restructuring called for the consolidation in the automotive and power-generation industries based on excess capacity and unproductive investment in duplicated facilities. In October 1980, the Government announced the reorganization of the next four industries—copper smelting and refining, electronic switching systems (ESS), marine diesel engines, and heavy electrical equipment. Except for ESS, the industries were weak or experiencing financial diffi-

culties. In the restructuring, there was to be only one surviving firm or an industry with a domestic monopoly for a specific product.

To stimulate the economy, new projects for industry or public infrastructure were being planned or on the drawing boards. Large port expansion projects for both Pusan and Inchon were in the design stage. An integrated steel mill and an industrial port were being planned for Asan Bay. A major ESS for telecommunications equipment was awarded to a U.S. company. A third and fourth subway line was to be constructed in Seoul, and a subway system was planned for Pusan. The Government was to contract for an environmental master plan for the Han River that includes Seoul. A multimillion dollar sewage treatment project was being considered for the Seoul metropolitan area.

The Government's mining policy emphasizes the development of domestic mineral resources, especially strategic minerals, and on improving miners' wage levels. Both state-run and private mines were encouraged to continue surveys on the feasibility of deep seam mining. In addition, the Government conducted geologic surveys in central Korea for developing uranium and thorium.

In 1979, the Government budgeted $112 million in loans and investments for mining. This amount represented 2.9% of total Government loans in 1979 compared with 2.8% in 1978. The value added of the domestic mining industry output totaled $642 million at current prices in 1979 or $301 million in 1975 constant market prices, a real growth of only 0.1%.

PRODUCTION

South Korea is a significant mine producer of only six mineral commodities—anthracite, graphite, kaolin, pyrophyllite, talc, and tungsten. While mineral raw materials for most of the country's needs are imported, there is limited domestic mine output of iron ore, copper-lead-zinc, gold and silver, and fluorite. The industrial production index (1975=100) for all items in 1980 was 209.7 compared with 111.2 for mining and 215.8 for manufacturing. The 1980 index for coal mining was 105.4; for metal ore mining, 103.9; and all other mining, 139.2. The 1980 index for petroleum refining was 152.5; nonmetal mineral products, 185.2; iron and steel, 310.8; nonferrous metals, 354.7; and fabricated metal products, 274.8.

There is no domestic production of oil and natural gas. Most of the country's production of primary metals, such as aluminum, copper, and iron and steel, is from imported ore and concentrates. At the end of 1980, the total production capacity for refined oil was 640,000 barrels per stream day; cement, 23.45 million tons per year; nitrogen fertilizers, 0.744 million tons per year; and steel, 8.8 million tons per year.

Table 1.—Republic of Korea: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal, primary	17,946	18,340	20,155	21,751	21,265
Antimony, mine output, metal content	11	--	(2)	--	--
Arsenic, mine output, white arsenic equivalent	r933	r647	548	e590	NA
Bismuth metal	174	r133	122	87	123
Cadmium metal, smelter	NA	20	40	50	365
Copper:					
Mine output, metal content	2,255	1,748	717	475	372
Metal:					
Smelter	30,900	r36,800	54,900	48,200	64,100
Refined including secondary	r30,911	r42,800	52,442	63,082	72,931
Gold metal, troy ounces	r18,748	r21,392	27,397	24,077	41,204
Iron and steel:					
Iron ore and concentrate:					
Gross weight, thousand tons	755	791	693	639	619
Iron content, do	423	443	388	358	347
Pig iron, do	1,937	2,425	2,741	5,063	5,577

See footnotes at end of table.

Table 1.—Republic of Korea: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Iron and steel —Continued					
Ferroalloys:[3]					
Ferromanganese	29,500	36,500	47,500	53,000	54,279
Ferrosilicon	34,733	26,826	30,800	38,000	29,712
Other	492	507	584	21,151	24,761
Total	64,725	63,833	78,884	112,151	108,752
Crude steel (excluding castings) thousand tons	2,698	2,737	3,138	5,200	5,790
Lead:					
Mine output, metal content	14,533	16,552	16,100	11,073	11,532
Metal, smelter	7,781	6,742	7,218	7,600	5,479
Manganese ore and concentrate:					
Gross weight	1,383	664	747	35	81
Manganese content	553	266	299	14	32
Molybdenum, mine output, metal content	120	101	220	189	300
Rare-earth metals: Monazite concentrate, gross weight	(2)	(2)	(2)	(2)	--
Silver metal thousand troy ounces	r1,858	r2,106	1,385	2,278	2,292
Tin, mine output, metal content	35	15	19	31	8
Tungsten, mine output, metal content	2,587	2,635	2,801	2,713	2,737
Zinc:					
Mine output, metal content	59,136	68,355	66,440	62,477	56,787
Metal, primary	27,548	32,756	58,970	83,014	79,150
NONMETALS					
Asbestos	4,762	6,180	13,616	14,804	9,854
Barite	4,174	r2,646	1,005	728	410
Cement, hydraulic thousand tons	11,873	14,196	15,133	16,413	15,631
Clays: Kaolin[4]	379,595	356,660	366,370	374,423	273,767
Diatomaceous earth	13,483	22,980	18,845	23,915	25,101
Feldspar	26,208	49,374	69,200	68,238	71,972
Fluorspar, metallurgical-grade	20,270	12,981	11,368	8,450	6,912
Graphite:					
Crystalline	3,413	3,446	2,534	2,453	1,429
Amorphous	38,277	62,509	53,785	54,240	59,157
Total	41,690	65,955	56,319	56,693	60,586
Kyanite and related materials: Andalusite	520	115	61	60	82
Lime, slaked thousand tons	e110	60	e60	60	210
Mica: Sericite	5,314	10,133	16,923	10,005	10,330
Nitrogen: N content of ammonia	602,792	725,133	896,911	960,623	847,871
Pyrite, gross weight	1,632	--	--	562	460
Salt	694,000	794,000	650,000	500,000	455,000
Sodium compounds: Sodium carbonate, manufactured	155,457	170,467	176,098	203,792	221,920
Stone, sand and gravel:					
Agalmatolite	280,826	375,509	397,573	430,890	371,932
Crushed and broken limestone thousand tons	19,099	22,734	24,153	28,112	28,024
Quartzite do	298	333	265	392	291
Sand (including glass sand) do	301	335	348	513	510
Sulfur:					
S content of pyrite	490	--	--	169	138
Byproduct:					
Of metallurgy[e]	22,000	r33,000	r47,000	r54,000	54,000
Of petroleum[e]	25,000	r31,000	r34,000	r36,000	36,000
Total	47,490	r64,000	r81,000	r90,169	90,138
Talc and related materials:					
Pyrophyllite	348,694	r443,304	463,005	541,383	514,511
Talc	147,774	171,926	202,078	236,824	204,662
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	31,646	38,248	51,989	58,284	74,122
Coal: Anthracite thousand tons	16,427	17,268	18,054	18,208	18,624
Coke do	960	1,165	1,319	2,331	2,550
Fuel briquets: Anthracite briquets do	13,962	NA	NA	16,942	17,000
Peat	e4,000	--	--	--	--
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	5,332	r7,004	7,989	8,712	7,085
Jet fuel do	4,958	5,835	5,390	5,495	4,920
Kerosine do	4,244	r4,522	6,791	8,912	8,811
Distillate fuel oil do	25,628	r30,242	34,444	38,056	38,199
Residual fuel oil do	r70,523	r79,932	85,953	91,135	90,766

See footnotes at end of table.

Table 1.—Republic of Korea: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum refinery products —Continued					
Lubricants ___ thousand 42-gallon barrels__	952	[r]1,191	1,386	1,512	1,403
Other _____do____	16,416	[r]24,840	26,168	27,747	29,725
Refinery fuel and losses_____do____	[r]4,354	[r]3,937	5,857	7,024	1,952
Total _____do____	132,407	157,503	173,978	[1]188,593	182,861

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Sept. 24, 1981.

[2]Revised to zero.

[3]In addition to ferromanganese and ferrosilicon (listed separately below), silicomanganese also apparently was produced during 1976-80; for the years 1976-78, it apparently is included with either ferromanganese or ferrosilicon, while for the years 1979-80, it is included with other.

[4]Figures presented are those published by the National Bureau of Statistics, Economic Planning Board, Government of the Republic of Korea, and are believed to represent salable production; another set of figures produced by the Ministry of Energy and Resources, and believed to represent crude mine output, is as follows in metric tons: 1976—470,251; 1977—534,591; 1978—549,940; 1979—698,432; and 1980—577,761.

TRADE

In 1980, Korea's total trade reached $39.8 billion ($17.5 billion for exports and $22.3 billion for imports). Imports of mineral products, comprised of nonmetallic minerals, mineral fuels, and metallic ores, totaled $7.2 billion; mineral fuels alone accounted for $6.6 billion. Imports of base metals were $1.9 billion, and for gem stones and precious metals, $44 million. Imports of nonmetallic articles, not elsewhere classified, were $114 million in 1980. Receipts of chemicals totaled $1.6 billion, which included inorganic chemicals ($138 million) and fertilizers ($37 million). The country's largest export categories by value were textiles and miscellaneous clothing accessories, $5.7 billion; base metals and articles thereof, $2.5 billion; machinery, mechanical appliances, and electrical equipment, $2.3 billion; and motor vehicles and associated transport equipment, $1.2 billion.

The principal sources for imports in 1980 were Japan, $5.9 billion; the United States, $4.9 billion; Saudi Arabia, $3.3 billion; Kuwait, $1.8 billion; Australia, $0.68 billion; the Federal Republic of Germany, $0.64 billion; and Indonesia, $0.48 billion. Major destinations for Korea's exports were the United States, $4,607 million; Japan, $3,039 million; Saudi Arabia, $946 million; the Federal Republic of Germany, $875 million; Hong Kong, $823 million; the United Kingdom, $573 million; Indonesia, $366 million; the Netherlands, $349 million; and Canada, $343 million.

Table 2.—Republic of Korea: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms _____	6,032	3,766	__	Japan 2,552; Saudi Arabia 349; United Arab Emirates 292.
Bismuth metal including alloys, all forms _____	38	119	62	Netherlands 54.
Copper metal including alloys, all forms _	1,440	1,888	772	Japan 811; Hong Kong 148.
Iron and steel:				
Ore and concentrate _____	7	30	__	Malaysia 20; United Kingdom 10.
Metal:				
Scrap _____ thousand tons__	8	13	__	Japan 8; Singapore 5.

See footnotes at end of table.

Table 2.—Republic of Korea: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Pig iron, ferroalloys, similar materials -- thousand tons--	30	44	(1)	Japan 35; Indonesia 7.
Steel, primary forms ---do----	166	898	106	Japan 196; Philippines 122; Venezuela 103.
Semimanufactures:				
Bars, rods, angles, shapes, sections -------do----	144	422	35	Saudi Arabia 204; Egypt 43; Kuwait 38.
Universals, plates, sheets do----	904	1,261	353	Japan 250; Indonesia 78; Malaysia 59.
Hoop and strip ----do----	11	17	(1)	Japan 7; Singapore 5.
Rails and accessories do----	2	2	--	Mainly to Singapore.
Wire ----------do----	28	38	4	Saudi Arabia 19; Japan 5.
Tubes, pipes, fittings do----	534	503	356	Saudi Arabia 68; Japan 20.
Castings and forgings, rough do----	34	36	10	Japan 11; Saudi Arabia 8.
Gold:				
Ore and concentrate ----------	--	300	--	All to Japan.
Metal including alloys, unwrought and partly wrought -troy ounces--	6,807	--		
Lead:				
Ore and concentrate ----------	10,685	6,600	--	All to Japan.
Metal including alloys, all forms ---	52,222	4,590	--	Mainly to Japan.
Molybdenum ore and concentrate-----	120	374	23	West Germany 215; Netherlands 60; Sweden 40.
Nickel metal including alloys, all forms -	r2	3	(1)	Mainly to Saudi Arabia.
Platinum-group metals:				
Waste and sweepings -----value--	$142,192	$36,436	--	All to Japan.
Metal including alloys, unwrought and partly wrought -troy ounces--	r187	187	26	Japan 161.
Silver:				
Ore and concentrate ----------	2,130	2,000	--	All to Japan.
Waste and sweepings -----value--	--	$286,405	--	Do.
Metal including alloys, unwrought and partly wrought thousand troy ounces--	1,646	1,805	--	Do.
Tin:				
Ore and concentrate ----------	37	10	--	All to United Kingdom.
Metal including alloys, all forms ---	19	1	1	
Tungsten:				
Ore and concentrate ----------	2,361	1,915	60	Japan 843; West Germany 467; France 225; Sweden 205.
Metal including alloys, all forms ---	612	599	251	Japan 102; West Germany 76; Singapore 62.
Zinc:				
Ore and concentrate ----------	8,118	--		
Oxides and peroxides ----------	758	1,379	--	All to Japan.
Metal including alloys, all forms ---	8,354	9,000	1,201	Japan 4,606; China, mainland 1,293; Pakistan 775.
Other:				
Ash and residue containing nonferrous metals ----------	--	1,821	--	Japan 1,651; Netherlands 83.
Oxides, hydroxides, peroxides -----	115	464	--	Pakistan 168; Thailand 145; Indonesia 75; Japan 60.
Base metals including alloys, all forms ----------	271	597	412	Japan 122; Netherlands 56.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc ----------	--	50	--	All to Japan.
Grinding and polishing wheels and stones ----------	336	592	1	Indonesia 550; Saudi Arabia 32.
Asbestos ----------	10	8	--	Saudi Arabia 6; Japan 2.
Boron materials: Boric acid--------	--	4	--	All to Japan.
Cement---------- thousand tons--	2,878	2,439	--	Hong Kong 939; Thailand 411; Singapore 320; India 256.
Chalk ----------	23	--		
Clays and clay products:				
Crude:				
Kaolin ----------	88,112	82,416	--	Japan 65,690; China, mainland 15,896.
Other ----------	36,196	34,888	--	Japan 31,148; China, mainland 3,240.
Products:				
Refractory including nonclay brick ----------	280	74	--	Saudi Arabia 43; Japan 31.
Nonrefractory ----------	66,545	72,980	33,682	West Germany 10,407; Netherlands 5,401.

See footnotes at end of table.

Table 2.—Republic of Korea: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond:				
Gem, not set or strung ____ value	r$111,787	$573,667	$37,037	Japan $487,974; Belgium $23,360.
Industrial ____ do ____	r$6,150	$28,878	$5,097	Japan $23,781.
Diatomite and other infusorial earth ____	60	20	--	All to Indonesia.
Feldspar ____	22,080	13,380	--	China, mainland 13,080; Japan 300.
Fertilizer materials, manufactured:				
Nitrogenous ____	661,291	474,961	--	Philippines 175,580; Sri Lanka 52,500.
Phosphatic ____	40,451	28,135	1	Japan 28,134.
Potassic ____	40	1	--	All to Japan.
Other including mixed ____	419,610	623,366	13,500	Turkey 209,915; Iran 186,300; Pakistan 71,447.
Fluorspar ____	1,152	470	--	Japan 300; China, mainland 170.
Graphite, natural ____	50,807	46,520	10,500	Japan 23,850; China, mainland 10,780.
Gypsum and plasters ____	109,095	59,319	--	Indonesia 33,000; China, mainland 21,685; Japan 4,634.
Lime ____	480	544	--	Bahrain 400; Saudi Arabia 144.
Magnesite ____	550	900	--	Japan 550; China, mainland 250; Thailand 100.
Mica, all forms ____	1,100	672	--	Japan 612; China, mainland 60.
Pigments, mineral: Iron oxides, processed ____	--	25	--	All to Saudi Arabia.
Precious and semiprecious stones except diamond[2] ____ kilograms	70	8	2	Japan 3; Hong Kong 2.
Salt ____	1,111	399	--	Saudi Arabia 349.
Sodium and potassium compounds, n.e.s.	(1)	8,100	--	All to Indonesia.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous ____	330	301	--	All to Japan.
Slate ____	62	23	--	Japan 22; Libya 1.
Other ____	100,746	229,507	--	Japan 228,101; China, mainland 1,406.
Worked:				
Slate ____	219	1,352	2	Saudi Arabia 1,071; Japan 257.
Paving and flagstone ____	785	116	--	Saudi Arabia 112; Bahrain 4.
Other ____	39,501	40,212	33	Japan 40,137.
Dolomite, chiefly refractory grade ____	167,648	126,657	--	Japan 126,600; Philippines 57.
Gravel and crushed rock ____	4,072	2,772	--	Japan 2,501; Philippines 150.
Limestone except dimension ____	36	10	--	All to Saudi Arabia.
Quartz and quartzite ____	24,589	36,104	--	Japan 35,470; China, mainland 634.
Sand excluding metal-bearing ____	16,074	4,203	--	Japan 4,202; Saudi Arabia 1.
Sulfur: Sulfuric acid ____	15	7	--	All to Saudi Arabia.
Talc, crude and ground including natural steatite ____	80,454	69,134	993	Japan 49,173.
Other:				
Crude ____	282,404	301,800	--	Japan 203,958; China, mainland 92,150.
Slag, dross, similar waste, not metal-bearing ____	75,429	72,326	--	Japan 49,173; Thailand 7,210.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals ____	27,537	4,099	--	Saudi Arabia 1,163; Japan 839; Kuwait 773.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural ____	--	5	--	All to Saudi Arabia.
Carbon black ____	21	--		
Coal, all grades, including briquets ____	150	--		
Coke and semicoke ____	1,851	1	--	All to Saudi Arabia.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	14	--		
Jet fuel ____ do ____	162	--		
Kerosine ____ do ____	24	--		
Distillate fuel oil ____ do ____	82	--		
Residual fuel oil ____ do ____	--	63	NA	Indonesia 1.
Lubricants ____ do ____	20	26	(1)	Indonesia 9; Singapore 7.
Liquefied petroleum gas ____ do ____	r958	229	--	Japan 144; Hong Kong 56.
Unspecified ____ do ____	r1,416	568	--	Japan 447.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ____	r60,134	95,621	--	Japan 91,029; Bangladesh 1,751; India 1,000.

rRevised. NA Not available.

[1]Less than 1/2 unit.

[2]Excludes unreported quantities valued at $5,953,200 in 1978 and $244,143 in 1979.

Table 3.—Republic of Korea: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	1,979	1,860	--	Japan 960; Malaysia 600; China, mainland 300.
Oxides and hydroxides:				
For use in aluminum manufacturing	32,451	31,139	--	All from Japan.
Other	28,301	4,578	31	Japan 4,498; West Germany 40.
Metal including alloys, all forms	107,388	135,084	13,641	Canada 16,559; Bahrain 15,095.
Antimony:				
Ore and concentrate	192	480	--	Bolivia 185; Malaysia 157.
Metal including alloys, all forms	106	65	3	Bolivia 25; Chile 25; Spain 10.
Arsenic trioxide, pentoxide, acids	22	--		
Beryllium metal including alloys, all forms kilograms	--	14	--	All from Japan.
Chromium:				
Chromite	3,755	9,344	--	Australia 4,439; Philippines 3,645; Japan 1,200.
Oxides and hydroxides	1,023	1,213	704	Japan 381; West Germany 125.
Cobalt:				
Oxides and hydroxides	26	16	(1)	Belgium 9; Japan 6.
Metal including alloys, all forms	34	70	5	Belgium 30; Japan 24; West Germany 4.
Copper:				
Ore and concentrate	55,766	128,809	--	Philippines 10,224; Chile 14,861; Canada 10,008.
Matte	410	--		
Metal including alloys, all forms	92,512	1,875	1,332	Peru 497; Kuwait 35.
Gold metal including alloys, unwrought and partly wrought troy ounces	89,684	155,420	85,864	Singapore 45,954; Japan 20,217.
Iron and steel:				
Ore thousand tons	3,623	7,517	--	Australia 3,192; India 2,025; Peru 1,348.
Metal:				
Scrap do	1,694	1,580	1,301	Australia 160; Japan 82.
Pig iron, ferroalloys, similar materials do	38	91	(1)	Japan 33; Brazil 24; Indonesia 13.
Steel, primary forms do	1,628	1,576	10	Japan 1,197; Australia 140; France 69; China, mainland 44.
Semimanufactures:				
Bars, rods, angles, shapes, sections do	648	473	7	Japan 384; United Kingdom 15; China, mainland 15; Brazil 10.
Universals, plates, sheets do	821	430	8	Mainly from Japan.
Hoop and strip do	186	225	(1)	Japan 128; Australia 93.
Rails and accessories do	27	24	(1)	Canada 13; Japan 7.
Wire do	70	61	(1)	Japan 57; China, mainland 2.
Tubes, pipes, fittings do	2,282	96	1	Mainly from Japan.
Castings and forgings, rough do	12	15	2	Japan 11; United Kingdom 1.
Lead:				
Oxides	176	70	--	Mexico 68; Japan 2.
Metal including alloys, all forms	44,420	49,355	16,283	Peru 8,518; Kuwait 7,497; Japan 5,225.
Magnesium metal including alloys, all forms	227	353	314	Japan 37; Switzerland 2.
Manganese:				
Ore and concentrate	127,193	225,829	--	India 96,700; Australia 88,059; Gabon 29,433.
Oxides and hydroxides	1,260	1,744	18	Japan 1,616; Belgium 108.
Mercury 76-pound flasks	990	761	40	Japan 721.
Molybdenum metal including alloys, all forms	13	9	1	Japan 7; France 1.
Nickel:				
Matte, speiss, similar materials	69	89	--	Mainly from Canada.
Oxides and hydroxides	104	4	--	France 2; Japan 2.
Metal including alloys, all forms	1,694	2,730	353	Canada 1,349 ; Japan 408; Australia 96.
Phosphorus, elemental	17	44	--	West Germany 27; United Kingdom 10; India 5.
Platinum-group metals:				
Waste and sweepings value	--	$36,436	--	All from Japan.
Metals including alloys, unwrought and partly wrought troy ounces	r130,698	99,592	5,547	West Germany 47,685; Japan 35,530; United Kingdom 9,390.
Rare-earth metals including alloys	(1)	14	(1)	Japan 11; West Germany 3.
Selenium, elemental	3	2	--	Mainly from Japan.
Silicon, elemental	346	880	196	Norway 374; France 126; Japan 70.

See footnotes at end of table.

Table 3.—Republic of Korea: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Silver:				
Waste and sweepings ____ value__	--	$286,405	--	All from Japan.
Metal including alloys, unwrought and partly wrought thousand troy ounces__	1,183	876	66	Japan 706; Yugoslavia 32; Bulgaria 26.
Tin:				
Ore and concentrate ____	693	543	--	Malaysia 326; Singapore 130; Indonesia 47.
Oxides ____ kilograms__	397	--		
Metal including alloys, all forms ___	1,623	6,502	14	Singapore 5,040; Malaysia 999; Indonesia 292.
Titanium:				
Ore and concentrate:				
Rutile ____	4,138	4,631	--	Australia 4,398; Austria 162; Japan 70.
Ilmenite ____	31,963	12,314	--	Malaysia 10,728; Japan 630; Canada 626; Australia 330.
Oxides ____	1,974	3,783	447	Japan 1,389; United Kingdom 739; West Germany 717; Australia 402.
Metal including alloys, all forms ___	3	82	1	Japan 74; United Kingdom 7.
Tungsten metal including alloys, all forms ____	18	29	2	Japan 17; Netherlands 9.
Vanadium pentoxide ____	1	1	1	
Zinc:				
Ore and concentrate ____	31,123	42,601	--	Australia 38,539; Peru 4,062.
Oxides ____	356	413	54	Japan 354; West Germany 5.
Metal including alloys, all forms ___	25,852	14,433	3,821	Japan 9,306; Australia 1,152.
Other:				
Ash and residue containing nonferrous metals ____	483	22,035	90	Japan 21,919; Canada 26.
Metals:				
Metalloids ____	36	42	--	Mainly from Japan.
Pyrophoric alloys ____	5	--		
Base metals including alloys, all forms ____	127	341	2	Japan 83; Sweden 10.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc ____	2,090	1,131	8	Japan 823; India 200.
Dust and powder of precious and semiprecious stones including diamond kilograms__	6,709	5,927	227	Japan 5,675; United Kingdom 2.
Grinding and polishing wheels and stones ____	703	733	37	Japan 634; West Germany 43.
Asbestos ____	48,898	58,616	2,806	Canada 11,132; Australia 2,891; Saudi Arabia 695.
Boron materials:				
Crude natural borates ____	396	345	--	Mainly from Japan.
Oxides and acid ____	1,664	2,204	2,089	Japan 107.
Cement ____	509,347	467,748	85	Japan 467,656; West Germany 7.
Clays and clay products:				
Crude ____	40,222	51,612	22,665	Japan 28,435.
Products:				
Refractory including nonclay brick ____	46,539	216,353	1,942	Mainly from Japan.
Nonrefractory ____	14,685	6,847	18	Japan 3,993; Philippines 1,339; Italy 690.
Diamond, industrial _ value,thousands__	$984	$1,307	$932	Japan $238; United Kingdom $66.
Diatomite and other infusorial earth ___	--	58	58	
Fertilizer materials:				
Crude, phosphatic _ thousand tons__	1,496	1,845	1,755	Nauru 78.
Manufactured:				
Nitrogenous ____	13,581	12,895	60	Japan 10,782; Chile 1,769.
Phosphatic ____	20	21	--	All from Japan.
Potassic ____	305,546	359,302	--	Canada 260,372; Israel 66,826; Belgium 30,098.
Other including mixed ____	28	23	21	West Germany 2.
Ammonia ____	3,005	19	6	Japan 10; West Germany 3.
Fluorspar ____	1,431	11,338	--	All from Thailand.
Graphite, natural ____	25	269	1	Japan 125; Sri Lanka 105; Singapore 15.
Gypsum and plasters ____	4,395	5,078	17	Morocco 5,050; Japan 11.
Iodine, fluorine, bromine ____	92	6	--	All from Japan.
Lime ____	16	50	--	Do.
Magnesite, crude and calcined, and magnesia clinker ____	25	7,014	172	Japan 6,797.

See footnotes at end of table.

Table 3.—Republic of Korea: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica:				
Crude including splittings and waste	207	163	52	India 65; Switzerland 35; Japan 10.
Worked including agglomerated splittings	42	74	(1)	Japan 70; West Germany 2.
Pigments, mineral, including processed iron oxides	947	1,256	453	Japan 678; West Germany 85; Belgium 23.
Precious and semiprecious stones, natural and synthetic, excluding diamond kilograms	217	[2]2,182	158	Japan 2,007.
Salt	387,391	489,880	--	Mainly from Australia.
Sodium and potassium compounds, n.e.s	61,221	180,024	120,051	China, mainland 31,700; Japan 23,965.
Stone, sand and gravel:				
Dimension stone, crude and partly worked	1,691	2,192	--	Italy 1,115; Japan 682; Brazil 317.
Dolomite, chiefly refractory grade	341	420	--	All from Japan.
Gravel and crushed rock	r7,154	539	--	France 462; Sweden 54; Belgium 18.
Quartz and quartzite	275	89	--	Sweden 70; Belgium 18.
Sand excluding metal-bearing	52,932	180,727	3	Australia 111,745; Japan 68,952.
Sulfur:				
Elemental	513,784	582,728	1,388	Japan 312,456; Canada 268,875.
Sulfur dioxide	28	--		
Sulfuric acid	57	90	16	Japan 72.
Talc, steatite, soapstone, pyrophyllite	198	334	93	Japan 198; Australia 35.
Other:				
Crude	4,759	7,222	94	Japan 1,717; West Germany 1,500; Australia 1,084.
Slag, dross, and similar waste, not metal-bearing	296,948	277,334	--	All from Japan.
Oxides, hydroxides, peroxides of magnesium, strontium, barium	2,923	779	4	Japan 737; Italy 38.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	819	1,032	495	Japan 454; Netherlands 47.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	44	338	72	Japan 194; Hong Kong 72.
Carbon black and gas carbon	6,169	19,147	16,127	Australia 1,425; Japan 1,272.
Coal including briquets:				
Bituminous coal thousand tons	2,067	4,217	702	Australia 2,462; Canada 1,018.
Anthracite and unspecified do	335	2,121	690	Vietnam 249; United Kingdom 148; Hong Kong 54.
Briquets of anthracite and bituminous coal	1,609	105,465	NA	NA.
Lignite including briquets	--	16,462	NA	NA.
Coke and semicoke	101,106	131,789	1,224	Japan 127,823.
Hydrogen, helium, rare gases	193	52	12	Japan 38.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	165,419	181,745	3,158	Saudi Arabia 102,817; Kuwait 54,556; Iran 14,894; Iraq 3,605.
Refinery products:				
Gasoline do	--	39	--	Mainly from Japan.
Kerosine and jet fuel do	214	2	2	
Distillate fuel oil do	989	4	(1)	Mainly from Japan and Panama.
Residual fuel oil do	2,112	9,978	6	Kuwait 2,815; Iran 2,738; Singapore 1,340.
Other:				
Lubricants do	2,873	1,243	59	Japan 585; Singapore 5.
Petroleum coke do	114	694	584	Canada 62; Japan 35.
Bitumen and other residues do	175	110	(1)	Singapore 61; China, mainland 48.
Bituminous mixtures do	1	--		
Unspecified do	374	319	103	Japan 213.
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals	45,087	54,237	15,930	Japan 38,307.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Total excludes an unreported quantity valued at $105,561.

COMMODITY REVIEW

According to the Ministry of Energy and Resources (MER), Korea's imports of key mineral resources (including petroleum) were $921 million in 1980 compared with comparable exports of $121 million. In 1979, imports of raw mineral resources were valued at $702 million against exports of $95 million, a 33% increase in deficit over that of the previous year. The growing demand for vital mining products in the course of rapid industrialization was cited as a key factor behind the deteriorating trade balance in this sector.

By value, the single largest mineral import class in 1980 was bituminous coal, used mainly for domestic power generation, and steel. Receipts of soft coal during the year were valued at $284 million, accounting for about one-third of the total import bill for raw mineral resources. The value of imported iron ore was up 40%, totaling $170 million. The cost for copper ore in 1980—$155 million—was double that of 1979. Copper was used mainly to manufacture communication equipment such as cables. The value of imports of platinum had the highest growth rate for raw mineral expenditure. Receipts for this class were $5 million, a sevenfold increase over the value in 1979. However, the value of uranium imports decreased from $44.7 million in 1979 to $26.3 million in 1980.[6]

Korea's self-sufficiency for minerals (excluding coal) has steadily declined. According to MER, the value for mineral demand in 1978 totaled 315.1 billion won, of which domestic production accounted for 86.6 billion won, a self-sufficiency rate of 27%. In 1979, the domestic demand for minerals was up sharply to 400.4 billion won, while domestic production increased only 9% to 94.5 billion won, a self-sufficiency rate of 22%. Furthermore, the self-sufficiency rate was expected to drop to 16% in 1980.[7]

METALS

According to estimates given by MER, Korea is dependent on foreign suppliers for about 20 kinds of minerals, and in most cases, to meet more than 90% of domestic demand. Domestic production meets the demand for only a few mineral commodities. Output from indigenous resources accounts for 100% of the domestic demand for molybdenum and tungsten; 76% for silver; 75% for zinc; 13% for gold; 8% for iron; 7% for tin; and 1% for copper. However, Korea is entirely dependent on imported nickel and aluminum.

Under a threefold plan proposed by the Ministry of Commerce and Industry (MCI) there was to be an increase in production of nonferrous metals, an ensured supply of raw materials, and an increase in trade activity. Also, as part of the plan, MCI proposed the stockpiling of lead, tin, zinc, copper, nickel, and aluminum and that the industry be granted various governmental financial and tax concessions. The stockpiling program was to be administered by the Korean Supply Administration Agency and the task of ensuring a smooth supply of raw materials by the Korea Mining Promotion Corp.[8]

Aluminum.—All of the country's output of primary aluminum was by one company, Korean Aluminum, Ltd. (Koralu), at its plant in Ulsan. Koralu is jointly owned by Hyundai Heavy Industries Ltd. (acquired the shares held by the Korean Development Bank) and by Aluminum Pechiney. Koralu imports alumina for all of its smelter requirements.

Domestic demand for aluminum was expected to reach 180,000 tons in 1981. In 1971, the largest use for aluminum was for kitchenware, 45%; followed by construction, 23%; electric cable, 19%; automotive, 3%; and miscellaneous, 10%. By 1978, aluminum consumption in Korea had greatly diversified: Construction, 32%; electric cable, 15%; automotive and kitchenware, each 12%; special uses and canning-packaging, each 11%; and miscellaneous, 7%.

Copper.—Consumption of copper in 1979 was estimated at 120,000 tons, but the demand for metal was projected to reach 180,000 tons in 1981. Total domestic copper refining capacity at yearend 1980 was 120,000 tons per year. The smelter, owned by Korea Mining & Smelter Co., Ltd., at Changhang, has an annual capacity of around 40,000 tons per year and the newly constructed smelter (commissioned in 1979) at the Kyongnam industrial estate of Onsan Copper Refinery Co., Ltd., has an annual capacity of 80,000 tons per year. Additionally, other annual output by Onsan Copper was to include sulfuric acid, gold, silver, selenium, and nickel sulfate. Contracts for concentrate for Onsan Copper included Mexico, Canada, and the Philippines.

In 1980, the Government directed a realinement of the copper industry, whereby Onsan Copper was to be the surviving company responsible for the country's output of copper. If additional capacity was needed to meet demand, priority would be

given to expand production at Onsan Copper.

Iron and Steel.—Almost half of the domestic mine output of iron ore was from the Yangyang Mine in Kangwon Province, operated by Dai Han Iron Mining Co., Ltd. During 1979-80, domestic mine production accounted for about 8% of the total supply, with the remainder supplied by imports of iron ore primarily from Australia and India. At the completion of the fourth-stage expansion program of the integrated steelworks of Pohang Iron and Steel Co. (Posco) in 1981, about 96% of the total demand for iron ore and all of its requirement for coking coal will be met by imports. Commissioning of the completion of Posco's expansion program was scheduled for February 1981, whereby the company's crude steel production capacity would increase from 5.5 million tons to 8.8 million tons. Total industry output capacity in 1981 would amount to 11,612,000 tons when the capacities of independent producers—Dongkuk Steel Mill Co., Inchon Iron Works Co., Kuckdong Steel Co., and Pusan Iron and Steel Co.—are included. Moreover, there were preliminary plans to increase the country's crude steel capacity further by constructing a 6-million-ton integrated steelworks on the west coast, perhaps at Asan Bay, or on the south coast at the Changwon industrial complex at Masan.

Posco produces a wide range of steel products such as hot- and cold-rolled sheet, coils, plates, billets and wire rods, and silicon steel sheets and strips. About 80% of its output are flat products that will be increased by the expansion. Posco's expanded output will be for both domestic demand and export. Domestic consumption of steel rose from 2.4 million tons in 1973 to 7.3 million tons in 1979, and was expected to reach almost 9 million tons in 1981.[9]

Construction in the fourth-stage expansion included the installation of a No. 4 blast furnace (inner volume of 3,795 cubic meters and capacity of 7,540 tons per day); a second hot-strip mill with four roughing stands and seven finishing stands, giving a total capacity of 3.2 million tons per year; a No. 2 continuous-casting plant (two 2-strand slab machines with a total capacity of 2.2 million tons per year); a No. 4 sinter plant; expansion of the cold mill; and doubling of the capacity of the No. 2 melting shop to 6.5 million tons per year.[10] The integrated steelworks at Pohang was claimed to be the 11th largest in the world.

Lead and Zinc.—Zinc consumption, estimated by MCI, was 80,000 tons in 1979 and was expected to reach 92,000 in 1981. The Onsan refinery of Korea Zinc Co. produces 50,000 tons per year of zinc, 100,000 tons per year of sulfuric acid, and 300 tons per year of electrolytic cadmium. The Sukpo zinc refinery of Young Poong Corp. (owns 41% of Korea Zinc) has a 31,000-ton-per-year capacity of electrolytic zinc, 55,000 tons per year of sulfuric acid, 170 tons per year of electrolytic cadmium, 1,400 tons per year of copper sulfate, and 1,700 tons per year of zinc dust. A small smelter (3,500 tons per year) in Seoul, operated by Tong Shin Co., was shut down in 1978.

The largest use of zinc was for galvanizing and the largest single user was Posco. Zinc consumption in Korea was as follows: Dry cell battery, 15%; galvanizing and tubes and pipes, 40%; sheet, 15%; die casting, 8%; paint, 5%; and alloys and brass, 15%.

Lead consumption in 1979 was estimated at 32,000 tons and demand was to reach 45,000 tons in 1981. Currently, the only lead production in Korea is by the copper smelter of Korea Mining and Smelter at Changhang with a lead production capacity of 4,200 tons per year. Korea Zinc began site preparation for the construction of a 30,000-ton-per-year lead smelter (to be expanded later to 50,000 tons per year) at Onsan in 1979. The $40.5 million smelter was to be financed by the International Finance Corp., Korea Development Bank, and Korea Zinc.[11]

Tungsten.—South Korea's production of tungsten concentrate (70% WO_3) was from ores averaging 0.8% to 1.9% WO_3. The Sangdong Mine of the Korea Tungsten Mining Co., Ltd., produced about 90% of the country's tungsten output. The remainder of the output was by Chungyang Co., San-Nae Mine; Okbang Mining Co., Ltd., Wol-Ak Mine; Ssangjon, Daewha Mine; and other small operations. The mill at Sangdong has a capacity to process 2,000 tons of ore per day; the concentrate produced is shipped to Korea Tungsten's plant at Taegu where it is processed to produce tungsten powder, carbide, and about 1,500 tons of ammonium paratungstate. South Korea's production of tungsten constitutes about 8% of the total world output.

The Korea Mining Promotion (KMPC) Corp. announced the discovery of a new tungsten deposit near the Sangdong Mine. The new find was said to have 1.4 million tons of ore containing 0.5% elemental tungsten.[12]

Other Metals.—Bismuth concentrates were produced as a byproduct of tungsten processing by Korea Tungsten Mining Co., Ltd. The bulk of silver metal output was by Korea Mining and Smelting and the Boonpyong operations of Young Poong Mining. Close to 65% of the country's output of gold metal was from the smelters of Korea Mining at Changhang and Onsan. Mine production of other metal values during the year included minor amounts of antimony, arsenic, manganese, molybdenite, and tin.

KMPC announced the discovery of Korea's largest molybdenite deposit at the Sangdong Mine in Yongwol County, Kwangwon Province (130 kilometers southeast of Seoul). The deposit was estimated to contain 80 million tons of 0.41% molybdenite ore.[13]

NONMETALS

In addition to construction aggregates, Korea has abundant resources of limestone and dolomite. According to MER, Korea's self-sufficiency for diatomaceous earth was 92%; fluorspar, 43%; and asbestos, 20%. However, Korea was totally dependent on foreign sources for phosphorus.

Cement.—Total cement production capacity by eight companies at yearend 1980 was 23,450,000 tons. Ssanyong Cement Industries Co., Ltd., the largest cement manufacturer in Korea, completed the expansion of its Donghae plant. The expanded plant has a cement capacity of 9 million tons per year. The Donghae area has extensive limestone deposits and is located just 8 kilometers from Bukpyung, a seaport undergoing development. The Donghae plant is serviced by a good transportation network with distribution terminals at Ulsan, Pusan, and Masan. The plant supplies Korea's east coast and interior demand as well as export markets.

Sung Shin Cement Co. expanded its Tanyang plant to 2 million tons per year. Sung Shin was also adding a grinding plant in Ulsan to supply the growing demand in the south.[14] In addition to Ssangyong and Sung Shin, other producers of cement were Asia Cement Manufacturing Co., Halla Cement Manufacturing Co., Hanil Cement Manufacturing Co., Hyundai Cement Co., Koryo Cement Co., and Tong Yang Cement Co.

Fertilizer Materials.—Total industry capacity to produce chemical fertilizers in 1980 were as follows, in thousand tons: Nitrogen, 850; phosphorus, 450; and potassium, 130. Total production of fertilizer increased during the past decade from 590,000 tons in 1970 and 860,000 tons in 1975, to 1,350,000 tons in 1980 (peak production of 1,438,000 tons occurred in 1979). During this period, consumption averaged 750,000 tons per year compared with 827,000 tons consumed in 1980; the highest consumption level was 886,000 tons in 1975.[15] Excess production is exported to countries in Asia and the Middle East. The major fertilizer manufacturers included Chinhae Chemical Co., Ltd.; Hankook Caprolactan Co., Ltd.; Korea General Chemical Corp.; Kyunki Chemical Co., Ltd.; Namhae Chemical Corp.; Posco; Pungnong Chemical Co., Ltd.; and Yong Nam Chemical Co., Ltd.

Korea Potassium, a joint venture of Oriental Chemical Industry of Korea and Diamond Shamrock of the United States, will establish the country's first potash plant at Inchon. Initial production was scheduled in 1981. Plant capacity is expected to be 10,000 tons per year each for caustic potash and for potassium carbonate.

Other Nonmetals.—Korea has been a large producer of natural graphite; although some crystalline graphite has been produced, it is best known for its amorphous graphite. The principal deposits are located near anthracite occurrences in Shung Chong Puk Do, Kiong Sang Puk Co, and Kang Won Do.

Production of other nonmetallic minerals during the year included agalmatolite, andalusite, asbestos, barite, diatomaceous earth, feldspar, fluorite, marine salt, and talc.

MINERALS FUELS

There is no commercial production of oil or natural gas on the Korean Peninsula. The principal domestic fuel source is anthracite. Total installed capacity for electric energy at yearend 1980 was 9,391,000 kilowatts. Thermal powerplants accounted for 81.4% of total installed capacity, followed by hydropower plants, 12.3%, and nuclear plants, 6.3%. Electric power generation during the year was 31,777 million kilowatt-hours for thermal plants; 1,984 million kilowatt-hours for hydropower plants, and 3,477 million kilowatt-hours for nuclear plants. Electric power consumption by the mining sector in 1980 totaled 674 million kilowatt-hours; primary metal producers, 4,681 million kilowatt-hours; metal products, 2,314 million kilowatt-hours; nonmetal sector, 2,608 million kilowatt-hours; and chemicals, 4,277 million kilowatt-hours.

Coal.—Under a long-term energy supply-

demand program (1981-91) planned by the Government, Korea's demand for coal was to grow 11.1% annually during the decade, from 14.6 million tons (oil equivalent) to 27.4 million tons in 1986, and to 39.0 million tons in 1991. The share of coal to total energy demand was to change from 30.4% in 1981, to 35% in 1986, and to 32.1% in 1991.

The current anthracite production level is around 18.3 million tons. Virtually all of the country's production was domestically consumed, primarily for space heating. The Government-owned Dai-Han Coal Corp. (DHCC) produced 26% of the country's output in 1980. Tangseong, the largest mine worked by DHCC, produced 2,250,000 tons in 1980; followed by Dogye, 986,000 tons. The remainder of DHCC's output was from a number of smaller mines. Private mines account for 74.3% of the national output. Production by private mines in 1980 were as follows: Consolidated coal mines, 4,020,000 tons, and small-scale mines, 9,818,000 tons. MER revised Korea's coal reserves downward to 830 billion tons in 1980. In a move for increased efficiency, the Government planned to designate DHCC in 1981 to monopolize the import of coal.

Exploratory work to delineate underwater coal deposits was to be undertaken on the east and west coasts. First-phase operations will begin with exploring the coastal area of Kangnung and Pukpyong in the east, and the coastal area of South Chung Chong in the west, as well as the Kanghwa and Kimpo areas in Kyonggi. Certain underground coal deposits in Korea extend deep out into the ocean, and exploration will be conducted to determine quantity, depth, width, and quality of underwater coal deposits.

Posco was participating in the development of the Tanoma coal mine in Pennsylvania (United States) and the Thorley Mine in Australia. Daewoo Industrial Co. was negotiating a plan to develop the Baralaba hard coal mine in Australia as well as one in the United States.

Petroleum.—Korea and Japan continued oil prospecting in the Continental Shelf between the two countries. Data from seismic surveys, collected by a West German group between October 30 and December 3, 1979, were being studied and processed. Two unproductive wells were drilled in 1980, the first drillings under the 8-year Korea-Japan joint development program of the Continental Shelf. Under this agreement, at least 11 wells were to be drilled in search for oil until 1987.

Korea's total oil refinery capacity at the end of 1980 was 630,000 barrels per day. Korea Oil Corp. operates an oil refinery with a daily refining capacity of 280,000 barrels at the Ulsan Petrochemical Industrial Complex on the southeast coast. Homan Oil Refinery Co. has a daily refining capacity of 230,000 barrels at Yosu. The refinery of Kyong-In Energy Co. has a daily refining capacity of 60,000 barrels, and the refinery of Korea-Iran Oil Co. has a capacity of 60,000 barrels.

Under the Government's economic development plan, the country's daily oil refinery capacity was to reach 1 million barrels in 1986. Moreover, the country's dependence on foreign oil was to be reduced through conservation and substitution. Oil-burning powerplants account for 74.2% of the total electric energy generation capacity. This will be reduced to 35% of the projected 17.6 million kilowatts in 1986 by switching to coal and by increased output capacity by nuclear reactors. Also, to stabilize the foreign supply of oil, the Government was to invest $373 million to expand oil refining and storage facilities.

Uranium.—Geologic drilling has confirmed the occurrence of uranium in Kapyong, Chinchon, and Pyonghae. Uranium ore near Okchon reportedly was sufficiently rich to yield 7,500 tons of refined uranium. A deposit in Kumsan County was estimated to contain around 12.55 million tons of 0.04% uranium. Uranium and vanadium were discovered at Koesan that was associated with low-quality coal. Based on the surveys for uranium through 1980, the Korea Energy-Resources Research Institute estimated that domestic uranium resources totaled 43.6 million tons, equivalent to about 10,000 tons of pure uranium. Geologic reconnaissance was to continue to discover new resources, especially in Chungchong and Kyonggi Provinces.[16]

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[1]Physical scientist, Branch of Foreign Data.

[2]The Hapdong News Agency, Seoul. Korea Annual 1980. 17th ed., June 1980, 732 pp.

[3]The value of the Korean won (W) to U.S. dollars declined from W484=US$1.00 in 1979 to W608=US$1.00 for 1980.

[4]Foreign Economic Trends (Korea). U.S. Department of State, March 1981, 13 pp.

[5]Economic Bulletin, Seoul. Economic Planning Board. No. 81-02, January 1981, 30 pp.

[6]The Korea Herald, Seoul. Trade Deficit in Mineral Products. May 7, 1981, p. 3.

[7]Haptong News Agency, Seoul. Mineral Self-Sufficiency. July 14, 1980.
[8]Metal Bulletin Monthly, London. Latest Asian Luminary. No. 105, September 1979, pp. 7-23.
[9]Far Eastern Economic Review, Hong Kong. An Iron-Handed Policy. Feb. 13, 1981, pp. 56-57.
[10]Metal Bulletin, London. Posco Reaches 8.5 Million Ton Mark. Feb. 20, 1981, p. 27.
[11]Work cited in footnote 8.
[12]Yonhap News Agency, Seoul. Molybdenite, Tungsten Deposits. Mar. 14, 1981.
[13]Honhap News Agency, Seoul. Large Uranium Deposit Discovery. Feb. 24, 1981.
[14]Rock Product. V. 83-84, April 1980, p. 121.
[15]Economic Planning Board, Seoul. Major Statistics of Korean Economy. 1981, 237 pp.
[16]Work cited in footnote 8.

The Mineral Industry of Kuwait

By Roman V. Sondermayer[1]

During 1980, as in the past, the economy of Kuwait remained completely dominated by the Government-owned petroleum industry. About two-thirds of the gross domestic product (GDP) was generated by the oil industry; the oil industry contributed approximately 85% of the total Government revenues, and crude oil exports accounted for close to 93% of total export earnings. Although crude oil output was far lower than in 1979, Kuwait retained its high position among all countries in per capita value of the GDP because of higher prices charged for crude oil.

Development of the refining and petrochemical sectors and utilization of natural gas (all associated gas) were given priority in Government planning. About $16.6 billion[2] was allocated for investments in the present 5-year plan (1977-81) for these purposes.

During 1980, major events in the mineral industry of Kuwait were the establishment of the Government-owned Kuwait Petroleum Corp. (KPC) and the planning for expansion and modernization of two refineries and drilling of two wells to reach the Khuff producing zone, this zone yields chiefly gas elsewhere in the Arabian Penninsula.

PRODUCTION AND TRADE

During 1980, according to preliminary reports, Kuwait was among the 10 largest producers of crude oil in the world. In addition to crude oil and associated gas production, Kuwait had three petroleum refineries and one gas processing plant in operation. Total capacity of the refineries was 594,000 barrels per day and that of the gas plant was 3 billion cubic meters per year. Output of other minerals was minimal and had only domestic significance. The petroleum sector was Government-owned or controlled, while production of other minerals was in private hands. Table 1 shows Kuwait production trends for the most recent 5-year period.

The trade tables 2 and 3 show the trend in Kuwait foreign trade for 1978, the latest year for which the complete data were available. Except for petroleum exports, foreign trade in minerals was modest by world standards. The United States exported to Kuwait steel pipes, bentonite, radioactive materials, lubricants, and bituminous mixtures.

Table 1.—Kuwait: Production of mineral commodities[1]

Commodity and unit of measure	1976	1977	1978	1979[p]	1980[e]
Cement ---------- metric tons	351,122	329,339	621,334	[e]630,000	625,000
Clay products, nonrefractory: Sand-lime bricks cubic meters	213,553	215,020	262,528	[e]270,000	265,000
Gas, natural:[2]					
Gross ---------- million cubic feet	395,805	362,751	392,838	460,324	300,000
Marketed ---------- do	196,950	210,510	221,069	304,128	250,000
Lime, hydrated, and quicklime ---- metric tons	12,301	19,656	3,837	[r e]11,800	12,000
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	5,305	5,638	5,415	6,000	6,100
Liquefied petroleum gas (propane and butane) do	14,543	14,965	13,853	16,000	16,200
Total ---------- do	19,848	20,603	19,268	22,000	22,300
Nitrogen, N content of ammonia ---- metric tons	422,000	402,000	431,000	[e]435,000	440,000
Petroleum:					
Crude[2] ---------- thousand 42-gallon barrels	[r]785,216	[r]718,685	777,961	912,610	602,000
Refinery products:					
Motor gasoline ---------- do	5,841	6,205	7,458	[e]8,700	8,800
Jet fuel ---------- do	4,251	4,088	3,104	[e]3,600	3,500
Kerosine ---------- do	5,990	3,979	10,608	[e]12,000	11,500
Distillate fuel oil ---------- do	31,701	30,222	30,160	[e]35,400	35,000
Residual fuel oil ---------- do	62,806	60,006	58,334	[e]68,400	68,000
Other:					
Naphtha ---------- do	19,558	18,891	18,581	[e]21,800	21,000
Asphalt ---------- do	502	502	729	[e]800	800
Unspecified ---------- do	1,438	1,303	1,551	[e]1,800	1,600
Refinery fuel and losses ---------- do	1,864	1,132	2,860	[e]3,300	3,300
Total ---------- do	133,951	126,328	133,385	[e]155,800	153,500
Salt ---------- metric tons	15,426	16,703	18,973	19,000	19,500
Sodium and potassium compounds: Caustic soda do	6,059	6,499	8,009	8,000	8,500
Sulfur:					
Elemental, petroleum byproduct ---- do	61,000	79,000	100,000	100,000	120,000
Sulfuric acid ---------- do	4,825	5,112	NA	NA	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through June 23, 1981.
[2]Includes Kuwait's 1/2 share of production in the Kuwait-Saudi Arabia Partitioned Zone.

Table 2.—Kuwait: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, unwrought and semimanufactures ----------	302	456	--	United Arab Emirates 175; Syria 106; Qatar 63.
Copper metal including alloys, unwrought and semimanufactures ----------	76	64	--	Saudi Arabia 43; United Arab Emirates 7; Jordan 7.
Iron and steel metal:				
Scrap ----------	14,334	6,019	--	Syria 2,110; Jordan 1,394; Iraq 1,122.
Semimanufactures ----------	178,389	62,156	--	Saudi Arabia 46,071; Iraq 5,730.
Lead metal including alloys, unwrought and semimanufactures ----------	319	259	--	Saudi Arabia 214; Iran 40.
Tin metal including alloys, unwrought and semimanufactures ---------- kilograms	--	850	--	All to Saudi Arabia.
Zinc, blue powder ----------	317	102	--	Saudi Arabia 99.
Other:				
Nonferrous metal scrap, n.e.s ----------	8,872	14,129	90	India 5,716; Pakistan 3,767.
Metals including alloys, all forms, n.e.s: kilograms	3,895	510	--	United Arab Emirates 500; Saudi Arabia 10.
NONMETALS				
Abrasives: Grinding and polishing wheels and stones ----------	28	25	--	Saudi Arabia 23; Egypt 1.
Cement ----------	58,058	19,584	--	Saudi Arabia 17,423; Jordan 1,913.

See footnotes at end of table.

Table 2.—Kuwait: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products (including all refractory brick):				
Crude: Bentonite	11,581	21,012	--	Iran 19,350; Saudi Arabia 1,232.
Products:				
Refractory (including nonclay brick)	200	399	--	Saudi Arabia 331; Qatar 61.
Nonrefractory	4,922	2,258	--	Saudi Arabia 1,844; Iran 160.
Fertilizer materials:				
Crude	141	66	--	All to Saudi Arabia.
Manufactured:				
Nitrogenous	558,159	602,973	--	India 165,512; China, mainland, 151,110; Pakistan 119,760.
Other including mixed	(1)	72,852	--	India 28,650; Iran 18,302; China, mainland, 10,100.
Ammonia	141,564	133,425	--	India 42,573; France 30,398; Turkey 27,884.
Gypsum and plasters	338	37	--	Bahrain 30; Saudi Arabia 7.
Lime	181	19	--	Saudi Arabia 15; Iran 4.
Precious and semiprecious stones, except diamond ---- grams	--	200	--	All to Australia.
Salt (excluding brine)	2,001	1,510	--	Jordan 584; Iraq 525; Saudi Arabia 300.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	3,719	6,987	--	Iraq 5,003; Saudi Arabia 1,818.
Soda ash	(1)	15	--	All to Iraq.
Stone, sand and gravel:				
Dimension stone, worked	2,025	959	--	Saudi Arabia 794; Qatar 124.
Gravel and crushed rock	1,864	1,270	--	Saudi Arabia 1,185; Iraq 35; Qatar 32.
Sand excluding metal-bearing	4,155	1,825	140	Iran 1,350; United Arab Emirates 285.
Sulfur:				
Elemental, all forms	70,436	164,257	--	India 160,830; United Arab Emirates 972; Saudi Arabia 969.
Sulfuric acid	3,317	212	--	Jordan 125; Qatar 72.
Other, crude	50	20	--	Saudi Arabia 18; Iraq 2.
MINERAL FUELS AND RELATED MATERIALS				
Coal and coke including briquets	4	50	--	Saudi Arabia 27; Iraq 20.
Petroleum:				
Crude[2] ---- thousand 42-gallon barrels	588,408	649,373	6	Japan 176,297; Netherlands 76,610; United Kingdom 71,995; Italy 65,127.
Refinery products:				
Shipments other than bunkers:[2]				
Gasoline ---- do	25,201	[3]25,637	--	Japan 12,575; Netherlands 6,181.
Kerosine and jet fuel ---- do	[r]8,551	10,675	--	Pakistan 3,430; India 1,472; Indonesia 1,258.
Distillate fuel oil ---- do	27,427	26,335	(1)	Pakistan 5,493; West Germany 2,964; Japan 2,871.
Residual fuel oil ---- do	[r]37,447	38,304	--	Japan 7,908; Australia 5,800; Taiwan 5,196.
Lubricants ---- do	21,958	20,556	(1)	Saudi Arabia 14,325; Lebanon 1,214.
Other:				
Mineral jelly and wax ---- do	(1)	(1)	--	Mainly to Qatar.
Liquefied petroleum gas ---- do	14,331	13,084	(1)	Japan 11,068; Lebanon 579; Turkey 465.
Bitumen and other residues ---- do	43	129	--	Iraq 83; Saudi Arabia 40.
Bituminous mixtures, n.e.s. ---- do	5	1	--	Mainly to Saudi Arabia.
Total ---- do	[r]134,963	134,721		
Bunkers:[4]				
Kerosine and jet fuel ---- do	[r]21	13	--	NA.

See footnotes at end of table.

Table 2.—Kuwait: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Bunkers[4] —Continued				
Distillate fuel oil, thousand 42-gallon barrels	840	597	--	NA.
Residual fuel oil ---do---	15,115	15,870	--	NA.
Total ---do---	r15,976	16,480		

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Includes Kuwait's 1/2 share of exports of the Kuwait-Saudi Arabia Partitioned Zone.
[3]Includes 121,000 barrels of natural gasoline.
[4]Excludes Kuwait's 1/2 share of exports of the Kuwait-Saudi Arabia Partitioned Zone.

Table 3.—Kuwait: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, unwrought and semimanufactures	10,749	9,815	--	Turkey 1,725; Italy 1,647; Bahrain 1,129.
Copper metal including alloys, unwrought and semimanufactures	1,590	1,783	317	United Kingdom 707; Japan 199.
Iron and steel metal:				
Scrap	814	609	126	Bahrain 272; Saudi Arabia 133.
Pig iron, ferroalloys, similar materials	140	25	--	All from United Kingdom.
Semimanufactures:				
Bars, rods, angles, shapes, sections	400,718	341,876	18	Japan 144,869; India 72,877; Italy 46,968.
Universals, plates, sheets	162,137	80,650	94	Japan 52,150; West Germany 15,226.
Wire	8,167	5,974	--	West Germany 2,053; China, mainland, 1,212; Japan 1,011.
Tubes, pipes, fittings	118,768	152,091	2,242	France 52,873; Japan 30,494; United Kingdom 24,708.
Lead metal including alloys, unwrought and semimanufactures	1,604	947	--	United Kingdom 487; Yugoslavia 169; West Germany 117.
Nickel metal including alloys, unwrought and semimanufactures ---kilograms---	--	200	--	All from United Kingdom.
Silver and platinum ---troy ounces---	96	--		
Tin metal including alloys, unwrought and semimanufactures	39	6	--	United Kingdom 3; West Germany 2.
Uranium, radium, thorium metals including alloys ---value---	$7,661	$18,817	$2,733	United Kingdom $7,605; France $4,005; West Germany $2,744.
Zinc, blue powder	r532	240	--	China, mainland, 115; West Germany 80.
Other:				
Nonferrous metal scrap, not subdivided	4,246	6,348	--	Saudi Arabia 4,627; Iraq 469; Netherlands 344.
Metals including alloys, unwrought and semimanufactures, n.e.s	69	42	--	Italy 18; West Germany 9; Netherlands 8.
NONMETALS				
Abrasives: Grinding and polishing wheels and stones	385	604	6	Italy 368.
Asbestos	8,248	6,285	--	Swaziland 5,785; Canada 500.
Cement ---thousand tons---	r1,641	2,346	(1)	Japan 652; Spain 438; Republic of Korea 264.
Clays and clay products:				
Crude:				
Bentonite	13,716	35,607	1,485	Ireland 21,858; Greece 9,334.
Crude earth for cement manufacture	4,130	190	--	All from Saudi Arabia.
Products:				
Refractory (including nonclay brick)	5,625	2,352	48	India 962; United Kingdom 474; Italy 256.
Nonrefractory	--	59	--	Iraq 35; United Kingdom 24.
Diamond, gem, not set or strung ---carats---	147,960	3,750	--	India 3,040; United Kingdom 250; West Germany 190.
Fertilizer materials:				
Crude, natural, all types	20	5	--	All from Iran.

See footnotes at end of table.

Table 3.—Kuwait: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Manufactured including mixed	412	404	--	West Germany 184; Netherlands 170.
Ammonia	267	17	--	India 10; West Germany 4; Iraq 2.
Graphite	108	50	--	All from United Kingdom.
Gypsum and plasters	30,331	81,603	--	Spain 37,257; France 18,596; Egypt 10,967.
Lime	23,331	27,459	--	Yugoslavia 11,193; Spain 9,876.
Precious and semiprecious stones except diamond kilograms	647	471	--	Czechoslovakia 321; Hong Kong 60.
Salt	5,186	5,674	1	Saudi Arabia 5,365; Iran 254.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	39	171	--	All from Saudi Arabia.
Soda ash	239	339	42	West Germany 107; Switzerland 60.
Stone, sand and gravel:				
Dimension stone, unworked:				
Marble	2,879	2,019	--	Italy 1,329; Jordan 554.
Mosaic stones, pebble, powder	112,984	131,712	--	Iran 76,510; Italy 39,200.
Other	3,831	472,102	--	Saudi Arabia 371,969; United Arab Emirates 94,233.
Gravel and crushed rock	12,963	325,823	--	United Arab Emirates 300,466; Italy 16,453.
Sand excluding metal bearing	1,638	435	--	Jordan 398; India 30; Syria 5.
Sulfuric acid	73	47	--	Netherlands 42; United Kingdom 4; West Germany 1.
Other, crude:				
Agricultural soil and clay	174	358	--	Netherlands 180; Jordan 70.
Chalks, colored soil, clay, n.e.s., and unspecified	2,451	2,450	9	India 830; Italy 732; Netherlands 247.
MINERAL FUELS AND RELATED MATERIALS				
Coal and coke, including briquets	676	369	85	United Kingdom 188; Iran 40.
Hydrogen, helium, rare gases	201	229	(1)	United Kingdom 113; Netherlands 47; West Germany 34.
Petroleum refinery products:[2]				
Gasoline:				
Aviation 42-gallon barrels	--	961	--	Iran 774; Iraq 187.
Motor do	264	--		
Kerosine and white spirit do	4,015	3,608	--	Iran 3,128; West Germany 480.
Distillate fuel oil do	754	--		
Lubricants do	293,713	213,130	32,542	Singapore 54,132; United Kingdom 33,612.
Other:				
Mineral jelly and wax do	363	68	--	West Germany 49; Hong Kong 19.
Bitumen and other residues do	77,416	144,169	--	Iran 100,103; India 22,415; Iraq 10,694.
Bituminous mixtures, n.e.s do	40,527	12,101	3,160	United Kingdom 5,682; Italy 2,280.
Total do	417,052	374,037		

rRevised.
[1]Less than 1/2 unit.
[2]Includes Kuwait's 1/2 share of imports of the Kuwait-Saudi Arabia Partitioned Zone.

COMMODITY REVIEW

METALS

Kuwait did not report production of metals during 1980. Iron and steel products, mostly welded pipes, were produced by Kuwait Metal Pipe Industry at its works in Safat. By yearend, the Aluminum Extrusion Co. had not announced any decision to build a planned plant for the production of 6,000 tons per year of aluminum products.

NONMETALS

Cement.—In the Kuwait-Saudi Arabia Partitioned Zone, construction continued on a 2-million-ton-per-year cement plant. Kuwait Cement Co. held 45% interest in the venture, and the Saudi-Kuwait Cement Co. of Saudi Arabia held the remainder. Plans call for completion of construction in 1981.

MINERAL FUELS

Petroleum and Natural Gas.—Kuwait was among the major Organization of Petroleum Exporting Countries producers of crude oil during 1980. However, Kuwait limited its crude oil output, with an aim to lowering the supply on a market that had more oil than the world needed. As all natural gas produced in Kuwait was associated gas, cuts in production of crude oil resulted in lower production of natural gas. This affected production of the new gas processing plant at Shuaiba, which operated only two of the three existing production lines.

In the oilfields, very few new developments were reported. Activities were mostly limited to continuations of old projects like deep drilling to reach the deep Permian Khuff formation. At the beginning of 1980, two test wells, up to 20,000 feet, were being drilled in the Burgan Field, and one development well was being drilled in the Magwa Field. In addition, modest seismic work was conducted by Kuwait Oil Co. (KOC) offshore and onshore, and plans were made for extensive exploration in the northern and western parts of the country. Exploration was targeted for discovery of hydrocarbons, but hope was expressed that new discoveries would be in the form of natural gas. A natural gasfield would make possible a cut in oil production without affecting operation of the gas processing plant. For the domestic market, production of propane, butane, and other gas plant products was important in the past and should remain so because these gases are the principal source of energy consumed domestically. As only the 200,000-barrel-per-day Shuaiba refinery has modern technology in use, plans for modernization of the other two were drawn up during 1980. According to reports, the modernization contract for the Mina al Ahmadi refinery was awarded to the Japan Gasoline Corp. When completed, the refinery should have capacity of about 250,000 barrels per day; the cost of modernization should be between $500 million and $700 million. The expansion and modernization of the refinery at Mina Abdullah reportedly should cost near $1.5 billion, increasing capacity to 250,000 barrels per day. When all programs for refineries are completed, Kuwait should have a refinery capacity of about 700,000 barrels per day and should be able to process almost one-half of its output of crude oil. The cuts in production resulted in drastic changes in Kuwait's contracts with oil purchasers. Volumes of crude oil contracted by Gulf Oil Corp., British Petroleum Corp., and Shell Oil Co. were slashed from 1.3 million to 850,000 barrels per day. Kuwait's oil industry administrative organization was changed. The new KPC had four wholly-owned subsidiaries as follows: KOC operated facilities for production of natural gas and crude oil; Kuwait National Petroleum Co. operated refineries which managed local distribution of products and production of liquefied gas; Kuwait's Oil Tankers Co. which was in charge of crude and products shipping; and Petrochemical Industries Co. which produced petrochemicals. In addition, KPC controlled 70% of the Kuwait International Petroleum Investments Co. (KIPIC). KIPIC was also organized during 1980; the company's capital was reported at $347 million. The company was authorized to undertake the following activities outside Kuwait: To build petroleum refineries and sell products; to build petrochemical plants, produce chemicals, and market them; to transport processed petroleum and chemical products and to own means of transportation; to construct storage facilities for crude oil, products, and natural gas; to prepare studies for, and undertake construction of, pipeline networks; and to manage projects related to the petroleum industry. The statute also permited KIPIC to acquire interests in or purchase companies similar to itself.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Kuwait Dinars (KD) to U.S. dollars at the rate of KD1=US$3.70.

The Mineral Industry of Liberia

By William F. Keyes[1]

Confidence in the Liberian business community was shattered in April by a coup which replaced the former Government with the People's Redemption Council, dominated by the military. Imports fell off, new investment decisions were postponed, and the Government encountered a severe liquidity squeeze, causing it to request a general debt rescheduling under the Paris Club of industrial countries. The coup also led to the postponement of consideration by new investors, including major companies already in the country, of construction of a steel mill, a new oil refinery, and several tree crop plantations. The investors' uncertainty was more severly felt because the coup followed stagnant economic conditions in 1979.

The iron ore industry dominated Liberia's gross domestic product (GDP) and exports, making Liberia greatly dependent on this one mineral. Production of about 20 million tons of iron ore annually is about 2% of the world total.

Other mineral production in Liberia included essentially small worker output of alluvial diamonds and gold, plus a cement clinker grinding plant in Monrovia.

PRODUCTION AND TRADE

Production of minerals in Liberia in 1980, and for the previous 4 years, is given in table 1.

Value of Liberian minerals exports for 1979, was as follows: iron ore $310 million; diamonds $39.1 million; and gold $377 million.

Table 1.—Liberia: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979[p]	1980[e]
Cement, hydraulic thousand metric tons	[e]100	[e]100	132	145	140
Diamond:					
Gem thousand carats	163	163	128	170	170
Industrial do.	162	163	180	132	130
Total do.	325	326	308	302	300
Gold[e] troy ounces	NA	NA	NA	1,086	1,000
Iron ore thousand metric tons	[r]20,530	[r]17,660	17,989	18,345	17,380
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	326	--	112	541	500
Jet fuel do.	258	--	45	252	250
Kerosine do.	79	--	24	68	60
Distillate fuel oil do.	1,309	NA	166	800	1,000

See footnotes at end of table.

Table 1.—Liberia: Production of mineral commodities[1] —Continued

Commodity[2] and unit of measure	1976	1977	1978	1979[p]	1980[e]
Petroleum refinery products —Continued					
Residual fuel oil					
thousand 42-gallon barrels	1,498	--	317	1,842	1,800
Other do	21	--	18	44	40
Refinery fuel and losses do	208	--	71	261	250
Total do	3,699	NA	753	3,808	3,900

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through July 10, 1981.
[2]In addition to the commodities listed, a variety of crude construction materials (clays, stone, and sand and gravel) were produced, but available information is inadequate to make reliable estimates of output levels.

COMMODITY REVIEW

METALS

Gold.—Liberian gold production in 1979 was reported during 1980 as 1,086 troy ounces, all produced by small surface miners.

Bruce J. Clayman Associates, which had conducted a detailed exploration of its concession area in 1978 and 1979, indicated that it might commence commercial production in 1980. The group found placer gold along the common boundary of Grand Gedeh and Maryland Counties and along the course of the Kana and Dabawolo Creeks in southeastern Liberia.

The Ministry of Lands and Mines launched a campaign aimed at promoting the mining of gold in Liberia. It was reported that there were many gold deposits across the country that could be worked economically by small miners, and with the increase in the price of gold these could contribute significantly toward helping the Liberian economy. The Ministry was to help by providing tools and equipment and by teaching simple methods of gold mining. Several suitable major areas were named, located in Cape Mount, Lofa, Bong, Grand Gedeh, and Sinoe Counties.

Iron Ore.—The iron ore industry continued to dominate Liberia's GDP and exports, and the country was uncomfortably dependent on this one commodity. The continued slump in the world steel industry in 1979 and 1980 left the demand for, and price of, iron ore only slightly above 1978 levels; iron ore consequently accounted for only about 54% of export revenue in 1979 compared with 71% in 1976, the last strong year for the industry. The Liberian Finance Minister reported that iron ore producers showed a $50 million total deficit in 1979, of which the major producer Liberian-American Swedish Minerals Co. (LAMCO) suffered a loss of $26 million. It was feared that revenues would remain low in 1980 and 1981, and Liberian Government support would be required to keep the mines operating through that period.

Three large companies produced iron ore in Liberia in 1980. All three were hard hit during 1980 by the world steel crisis and by inflation, which raised their operating costs significantly. The largest company was LAMCO Joint Venture (LJV) and its operating arm, LJV Operating Co., which produced about 10 million tons annually of beneficated products. LJV was controlled 75% by LAMCO which, in turn, was an equal partnership of Liberian Iron Ore Ltd. (LIO) and the Liberian Government; 25% of LJV was owned by Liberia Bethlehem Iron Mines Co. (Libeth). The largest participant in LIO is the Swedish mining company, Granges AB, which is the operator; Libeth is a subsidiary of Bethlehem Steel Co. of the United States. LAMCO early in the year obtained Government approval to layoff over 700 of its 4,800 workers on the condition that the layoffs apply equally to Liberians and expatriates (an earlier Liberianization decree had required LAMCO to reduce its expatriate staff of 523 by 70% by 1983).

LAMCO decided to open new resources at Tokadeh, near the major mine Mount Nimba (in northeastern Liberia on the Guinea and Ivory Coast borders), to exploitation by early 1981, at an estimated cost of $7.5 million. Tokadeh had yielded about 6.2 million tons of iron ore between 1973 and 1977, and smaller quantities since. The new reserves in the area, with 40% to 55% iron content, would require beneficiation; the ore would ultimately replace Mount Nimba ore, which contains 65% iron, but which was expected to be exhausted by 1986.

The second largest iron ore mining company was Bong Mining Co. (BMC). BMC, which produced about 7 million tons annu-

ally of finished products (concentrates and pellets) at its open pit mine in the Saladea district, north of Monrovia, was owned half by the Liberian Government and half by German steel companies through Exploration und Bergbau GmbH (33.75%) and the Italian steel company Finsider International S.S. (16.25%). BMC continued drilling to establish further ore reserves, and it expected to complete its program at Bong Peak by early 1981. A preliminary calculation showed 134 million tons of iron ore at Bong Peak, in addition to the 215 million tons already known at the main Bong Mines area.

The third iron ore producer was National Iron Ore Co. Ltd. (NIOC). Its Mano Mines operation at Kakata, northeastern Liberia, was still experiencing grave financial and technical problems. NIOC was owned by the Liberian Government (50%), and the other half was owned by private, largely Liberian, investors. NIOC's production (or shipments) was only about 1.6 million tons in 1980, and future operations were dependent on the outcome of discussions (in progress at year-end) with the World Bank and other lending institutions.

The Mifergui iron ore project in Guinea was predicated upon the use of LAMCO's railroad from Nimba to the Port of Buchanan. The LAMCO management was however concerned about taking on this added responsibility and also permitting the use of its facilities at Buchanan. A decision by the Liberian Government was awaited.

Investigations in the Wologisi concession were suspended after the April coup by the Liberian Iron & Steel Corp., 51% owned by the U.S.-controlled Liberian International American Corp. (LIAC). A group of Japanese steel companies, led by Kawasaki Steel Corp., had an option to acquire LIAC's share.

Manganese.—The Geological Survey of Liberia commenced a preliminary investigation of the manganese deposits at Mount Dorthrow, Grand Gedeh County, in eastern Liberia.

NONMETALS

Barite.—An exploration program was carried out by the Senwein Mining Corp. on the barite deposits in Monserrado, Bong, and Grand Bassa Counties of the Gibi Mining Agency (district), northeast of Monrovia. Three field parties identified previously reported outcrops and located three additional ones. It was hoped to bring in mining equipment during 1980, in view of the favorable market for barite in the world petroleum industry. Fuel costs were, however, a mounting concern.

Cement.—The capacity of the clinker grinding plant on Bushrod Island, Monrovia, was expected to be doubled from its current capacity of over 100,000 tons. The plant grinds only imported clinker.

Diamond.—The Ministry of Lands and Mines began surveying some 1,970 acres of diamond-bearing land, along the banks of the Lofa River in Grand Cape Mount County. The area was formerly held by the Globex Minerals Co., which had lost the concession by default. It was intended to grant the demarcated area to about 79 small miners. At the beginning of 1980, there were 1,201 prospecting licenses and 1,164 mining licenses for alluvial diamonds in force in Liberia.

Weasua Mining and Development Corp. applied for and was granted a concession in 1979, with the exclusive right to produce gold and diamonds, with associated minerals. The concession area, of approximately 230 square miles, was located in Grand Cape Mount County.

Delta Engineers (Liberia) Inc. was engaged in exploration activities, under terms of the contract granted in 1978, on a diamantiferous gravel area in Grand Cape Mount County. Twenty-two Liberians and four expatriates were employed.

Phosphate Rock.—The U.S. Geological Survey published a report[2] of a deposit of high-grade phosphate rock near Bambuta, 70 kilometers north of Monrovia and 25 kilometers east of the Bomi Hills iron mine, which holds 1.0 million tons containing about 32% P_2O_5 or 1.5 million tons containing 28% P_2O_5; additional tonnages may be available. The ore may be suitable for detergents, medicines, and other products; it contains iron and alumina and would have to be mixed with lime to serve as a fertilizer.

MINERAL FUELS

Petroleum.—Bidding documents were prepared for a 2,500-kilometer offshore seismic survey and were to be available after midyear. A loan from the International Bank for Reconstruction and Development (IBRD) was applied for as a continuation of the $5 million IBRD-financed analysis of existing offshore, seismic and test, well data.

The refinery of the Liberian Petroleum Refining Co. at Monrovia operated below its

designed 15,000-barrel-per-day capacity. This was because of disruptions and financial problems resulting from the political coup in April, and disagreement between Liberian Government officials and the Lummus Co. of the United States, which had a management contract due to expire about 1983.

Uranium.—Coastal Liberia Uranium Enterprises Inc. was conducting an investigation of about 29 radioactive anomalies, including three geologic field crews working for approximately 6 months. Projected exploration costs through March 1980 were estimated at $4.5 million.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Rosenblum, S. and S.P. Srivastava. The Bambuta Phosphate Deposit, Liberia, A Reconnaissance Report. U.S. Geol. Survey Bull. 1480, 1979, 26 pp.

The Mineral Industry of Libya

By Roman V. Sondermayer[1]

Libya remained basically a country with a one-commodity economy during 1980. Production of crude oil and natural gas was by far the most important economic activity. More than half of the gross national product (GNP) was generated by the petroleum and natural gas sector of the economy. Although production of crude oil during the year was the lowest since 1975 and exports of crude in 1980 dropped by 13.7%, when compared with exports in 1979, a price increase of about 35% kept the foreign trade balance in the black and increased foreign exchange reserves. To postpone the harsh economic consequences of ultimately running out of petroleum, the Government took a number of measures. One was to cut back oil production with increases of prices up to the maximum permitted by Organization of Petroleum Exporting Countries (OPEC) and to intensify exploration. The second was to prepare a comprehensive 5-year plan for 1980-85 aiming at reducing dependence on oil and gas by increasing industrial and agricultural production and by expanding the country's infrastructure. The 5-year plan was part of the comprehensive "Transformation Plan," which aimed to convert Libya to a welfare state largely independent of oil by the year 2000.

The major events related to the mineral industry of Libya were as follows: Planning for construction of an integrated steel works and development of an iron ore mine; completion of a petrochemical plant at Abu Kamash; construction of a petroleum refinery and a petrochemical plant at Ras Lanuf; cutting back all oil production allowables by more than 16.5%; and planning installation of the first offshore production platform in the country by Azienda Generale Italiani Petroli S.p.A. (AGIP).

PRODUCTION AND TRADE

The only mineral-related activities in private hands were those producing oil and gas. Almost all other private mineral companies have been nationalized. The recent trends in production of minerals in Libya are shown in table 1.

Libya's trade balance improved in 1980 because of higher prices charged for oil.

Table 1.—Libya: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979[p]	1980[e]
Cement, hydraulic thousand metric tons	1,500	2,500	3,200	2,721	2,800
Gas, natural:					
Gross million cubic feet	[r]633,789	[r]786,573	749,514	828,831	720,000
Marketed[3] do.	168,602	178,373	180,845	239,609	260,000
Gypsum thousand metric tons	60	290	180	181	180
Iron and steel: Crude steel[e] metric tons	10,000	10,000	10,000	10,000	10,000
Lime thousand metric tons	325	[r]300	220	225	230
Nitrogen: N content of ammonia[e] metric tons	--	--	80,000	[r]133,000	150,000
Petroleum:					
Crude thousand 42-gallon barrels	707,336	753,129	720,875	753,980	[4]654,405
Refinery products:					
Gasoline do.	2,372	2,409	3,189	4,380	4,300
Kerosine and jet fuel do.	2,701	9,672	6,330	5,110	5,100
Distillate fuel oil do.	6,460	9,016	11,936	11,315	11,300
Residual fuel oil do.	6,935	13,067	17,298	16,060	16,000
Other do.	146	219	3,759	6,570	6,500
Refinery fuel and losses do.	147	1,387	1,649	1,825	1,800
Total do.	18,761	35,770	44,161	45,260	45,000
Salt[e] thousand metric tons	10	10	15	10	10
Sulfur, byproduct of petroleum and natural gas[e] metric tons	[r]16,000	[r]17,000	[r]19,000	20,000	22,000

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Aug. 3, 1981.

[2]In addition to the commodities listed, a variety of construction materials (sand and gravel, crushed stone, brick, and tile) is produced, but available information is inadequate to make reliable estimates of output levels. Natural gas liquids are also produced but are blended with crude petroleum and are reported as part of that total.

[3]Series revised to exclude gas reinjected into reservoirs.

[4]Reported figure.

COMMODITY REVIEW

METALS

Iron and Steel.—During 1980, preliminary planning for development of an iron ore mine in the Wadi Shati Valley and construction of an integrated iron and steel works at Misurata on the Mediterranean coast were underway.

The Misurata plant was to be based on the Wadi Shati Valley iron deposit in western Libya, about 770 kilometers south of Misurata. A railway line will have to be constructed before mining can start.

The iron ore deposit follows the Wadi Shati Valley, a depression about 200 kilometers long and 20 kilometers wide. The ore is a sedimentary minette type of Jurassic age, and the formation dips gently from north to south. A magnetite central body is overlain and underlain by siderite and limonite. The principal gangue mineral is chlorite.

Reserves of magnetite were estimated at 420 million tons at a cutoff-grade of 47.5% Fe. At a 45.3% Fe cutoff-grade, reserves of nonmagnetic ores were reported at an additional 375 million tons.

The following tabulation shows the average composition of Wadi Shati Valley iron ore, as reported during 1980, in percent:

	Percent				
	Fe	SiO	CaO	AlO	P
Magnetic	47.5	4.5	2.2	4.10	0.90
Others	45.3	3.5	2.8	3.15	.85

The mine at Wadi Shati was planned for an output of 10 million tons of ore per year, probably by opencast nonselective mining methods. The ore will be trucked to the nearby site of a primary crusher where, in two stages, the ore will be reduced to 80 millimeters. Crushed ore will be transported from a storage area to Misurata by a standard gage railway, to be completed by 1986.

The mine site will have to have all ancillary facilities needed for operation of a mine in a remote area. The total labor force of about 5,000 persons will be housed in a small mining town planned near the mine. Reportedly most of the labor force will come from Chad, Niger, Tunisia, and Sudan.

NONMETALS

The only significant nonmetal produced in Libya was cement. Five cement plants

with a total capacity of 5 million tons per year were in operation during 1980. National Cement Co., with two plants near Homs, and Libyan Cement Co., with two plants near Benghazi, had an annual capacity of 2 million tons of cement each. The country was well supplied with raw materials for cement production, and cement companies produced most of the raw materials they consumed. Gypsum was produced south of Tripoli and east of Benghazi and Suk el Khamis. Salt from seawater was produced from several small plants along the coast. In addition, two larger salt-producing plants, one near Tripoli (22,000 cubic meters of brine per day) and another near Tobruk (24,000 cubic meters per day) were in operation. In addition to salt from seawater, large salt beds near Abu Kamash provide ample raw materials for salt production used in the Abu Kamash chemical plant.

MINERAL FUELS

Petroleum and Natural Gas.—During 1980, the petroleum and natural gas sector of the Libyan economy continued to slow down as a result of Government decisions. Implementation of a new program encouraging foreign oil companies to invest more in the oil and gas industry of the country in exchange for crude oil export rights was under way. Reportedly certain oil companies, not considered adequately active in investing in development of the Libyan oil and gas industry, had their contracts terminated or oil export quotas lowered. Some 13 new production-sharing exploration contracts were thus concluded with the operating companies, which agreed to invest about US$1 billion over 5 years in the country's petroleum industry. In these contracts, the share of the Libyan Government in future production was determined by the potential, as follows:

Oil and gas producing potential	Share in future production
Good	85% Government - 15% oil company
Medium	81% Government - 19% oil company
Low	75% Government - 25% oil company

In early 1980, the Government informed the oil companies in Libya of a reduction in allowable production rates as follows, in thousand barrels per day:

Operator	Before Apr. 1, 1980	After Apr. 1, 1980	Volume cut	Cut (percent)
Oasis Group	750	630	120	16.0
National Oil Corp. (Government of Libya)	560	540	20	3.6
Occidental	300	190	110	36.7
AGIP	200	160	40	20.0
Esso	185	135	50	27.0
Mobil	90	81	9	10.0
Elf-Aquitane	14	10	4	28.6
Wintershall	4	4	--	--
Total	2,103	1,750	353	16.8

Reasons for cutbacks were reportedly technical in nature. The notice did not specify field-by-field or well-by-well allowables as in the past.

Information on petroleum and natural gas exploration in Libya was fragmentary during 1980. It is estimated that about 12 to 15 drilling rigs drilled between 35 and 45 wells; apparently completed were 15 to 20 wells, and the total of meters drilled was between 80,000 and 100,000. Two offshore wells drilled by AGIP had oil and gas. Onshore AGIP announced discovery of oil in west Libya. Mobil had a discovery in the west Sirte Basin and one in the eastern part of the basin. Oasis reported two oil discoveries but details were not readily available, and Occidental made three discoveries in the Focha Dolomite in southwest Sirte.

Most of the development drilling was conducted in the Messla, Sarir, Aswad Sabah, and Zela Fields and Mobil started development of the Ghani Field in west Libya. In addition, AGIP was planning to install a production platform for 30 wells in the Gulf of Gabes, which will be the first offshore production facility in the country.

Nippon Kokan Kaisha and Marubeni Corp. of Japan received an order from Arabian Gulf Exploration Co. to lay 611 kilometers of 42-inch-diameter pipe. The new system will link the Misla Oilfields in the southeast with Ras Lanuf on the Mediterranean coast, where a new 220,000-barrel-per-day petroleum refinery and a petrochemical plant to be completed in 1984 were under construction.

The refinery, being built by Snamprogetti of Italy, and a 300,000-ton-per-day ethylene plant, being built by Stone & Webster,

comprise phase one of the Ras Lanuf project, which was about 20% to 25% completed by yearend 1980. Phase two of the project includes construction of a 50,000-ton-per-year ethylene glycol plant, a 50,000-ton-per-year butadiene plant, a 68,000-ton-per-year polypropylene installation, a 50,000-ton-per-year low-density polyethylene facility, and a 50,000-ton-per-year high-density polyethylene facility. Total cost of the project was reported at US$3 billion, of which US$1 billion was for the construction of the petroleum refinery.

During the celebration marking the 11th anniversary of Libya's "First September Revolution," a new petrochemical complex at Abu Kamash near the Tunisian border went onstream. The plant has an annual capacity of 60,000 tons of polyvinyl chloride, 50,000 tons of caustic soda, and 8,000 of hydrochloric acid. Total cost of the complex was reported at US$500 million, and Salzgitter Industriebau GmbH of the Federal Republic of Germany was the principal contractor.

[1]Physical scientist, Branch of Foreign Data.

The Mineral Industry of Madagascar

By Suzann C. Ambrosio[1]

Madagascar's mineral industry was a minor contributor to the 1980 gross domestic product (GDP), estimated at $2.4 billion in constant 1976 prices. The mineral industry, however, continued to provide an important source of foreign exchange during 1980. Chromite and graphite comprised approximately 90% of Madagascar's mineral trade. Other important minerals produced and exported included semiprecious, ornamental, and industrial stones. The value of mineral exports declined in 1979 to approximately $12 million and remained relatively low in 1980. Madagascar was the sole world producer of phlogopite mica, and remained an important supplier of U.S. mica and natural graphite during the year.

The Malagasy national economy, as measured by GDP, continued to grow at an annual rate of nearly 10%, in constant 1976 dollars. Large capital expenditures continued to be made for economic development. Investments for plant and equipment increased 17% between 1979 and 1980, reaching $190 million[2] by yearend 1980. The money supply grew at a rate of 23.2% in 1979 and 6.5% in 1980. Inflation was running at 16% annually in February 1980.

The Malagasy Government controlled over 75% of the national economy, over 90% of the exports, and 6% of the imports by yearend 1980. The Government was approaching $320 million in deficit financing by yearend 1980, and the Central Bank was estimated to show a deficit of nearly $640 million. Increased foreign borrowings and trade deficits have contributed to the relatively high ratio of debt service to export revenues (between 25% and 30% during 1980). The 1980 balance of trade was adversely affected by increased crude oil import bills and a decline in agricultural exports. The petroleum bill was reported to have tripled in 4 years, and drought conditions resulted in poor agricultural production. Imports increased approximately 20% in value in 1980, and restrictive controls continued to favor goods earmarked for development projects.

Ambitious plans have been outlined by the Minister of Economy to progressively develop the country's natural resources with a concurrent emphasis on import substitution. Agriculture, education, and other infrastructural support projects have consistently received the most favorable budget allocations. New mineral industry plans have focused on developing steel and expanding cement production. In addition, expansion of the nation's large chromite reserves and exploitation of the extensive iron, nickel, and coal deposits have received priority development status.

The future of Madagascar's mineral industry depends on the development of relatively inexpensive energy resources. The Andekaleka 116-megawatt hydroelectric plant under construction during 1980 was expected to be operational by yearend 1982. Construction was assigned to the Malagasy Electric and Water Co., with assistance from a Canadian engineering consulting firm. The first stage included setting up two 29-megawatt turboalternator units, and was estimated to cost $142 million. Madagascar was expected to finance approximately 10% of the cost, while various international and bilateral assistance programs were expected to provide the balance. By yearend 1980, over one-half of the civil engineering work was estimated to have been completed.

Exploration projects for petroleum, tar sands, and bituminous shale were delineated and investigations were conducted. Bids

for hydrocarbon exploration projects were submitted, and negotiations were under way in 1980. Law 80-001, the Madagascar Petroleum Code, was promulgated on June 6, 1980. The legislation covered mining titles, pipeline transportation, ocean hydrocarbons, the financial system, and all the rights and infractions associated with exploration, prospection, research, exploitation, and transportation of hydrocarbons. The code insured the country's control of the exploration and exploitation of its hydrocarbons by outlining the parameters of foreign participation.

PRODUCTION AND TRADE

Chromite, graphite, and mica continued to be the most important mineral commodities produced and exported in Madagascar during 1980. The mineral trade balance continued to worsen despite an overall increase in the total production of mined materials and metals products. Major mineral imports continued to be comprised of crude oil, metals, and cement.

Chromite outperformed other commodities in the mineral industry during the year. Production increased by approximately 40%, recovering from a 5-year low reported in 1979. Exports were estimated to decline, however, because of transportation and marketing difficulties. Chromite contributed approximately 50% of total mineral exports (excluding mineral fuels) and approximately 2% of total commodity exports between 1970 and 1975. Subsequent declines in production and trade have resulted in part from softened world demand for steel products, and the lack of chromite processing facilities in Madagascar. Approximately 40,000 tons of chromium ore, grading 40% to 46%, was exported to the United States in 1980.

Malagasy graphite production hit a 5-year low in 1980. Graphite was surface mined along the weathered parts of the deposits. Poor meteorological conditions and equipment failures were primarily responsible for declines in production and trade. Malagasy exports of crystalline graphite to the United States decreased 40% from 1979 to 1980, and comprised 57% of U.S. imports in 1979 and 28% in 1980. The world market for natural crystalline flake graphite continued to exhibit strong demand and short supplies during the year.

Madagascar's 1980 phlogopite mica production increased by 48%, and export growth exceeded 100% of the levels reported in 1979. Approximately 15% of Malagasy's mica production was classified as phlogopite splittings, and the majority of the remainder was classified as phlogopite sheet mica. The U.S. percentage of Malagasy mica imports declined from approximately 4% in 1979 to less than 1% in 1980. This was in part because of the growing competition from synthetic products and the varying requirements of the General Services Administration's strategic stockpile materials.

The majority of Madagascar's trade continued to be with the European Communities (EC). France had the largest market share of Madagascar's trade, and over 50% of Madagascar's trade deficit with the EC was with France. Slight shifts in Madagascar's geographic trade distribution were evident since 1978. Africa's share of Madagascan exports increased to 10%, and imports grew to 3%, along with increased trade volumes with China, Japan, and Canada. Algeria and Reunion became the principal African buyers, and Mozambique and the Ivory Coast became the principal African suppliers. Trade with the United States has substantially declined since 1978, primarily because of decreased purchases of coffee and vanilla.

Table 1.—Madagascar: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Beryllium: Beryl concentrate, industrial grade, gross weight	17	e15	11	10	e10
Chromium: Chromite concentrate, gross weight	221,172	164,710	137,552	136,000	146,530
Gold, mine output, metal content—troy ounces	160	76	125	125	114
NONMETALS					
Abrasives, natural: Garnet (industrial only) kilograms	4,281	NA	10,500	5,000	e5,000
Cement, hydraulic	74,000	52,229	66,044	70,000	60,050
Clays: Kaolin	25,397	2,152	2,596	1,899	2,858
Feldspar kilograms	--	1,093	e1,000	1,830	e1,800
Gem and ornamental stones:					
Agate do	133,806	147,200	98,400	7,514	14,381
Amazonite do	2,103	133	2,800	1,459	1,300
Amethyst:					
Gem do	--	4,700	26	31	10
Geodes do	1,475	NA	NA	2,393	3,400
Apatite (ornamental only) do	5	536	491	175	200
Aragonite	121	1,366	770	1,120	969
Beryl kilograms	3	1	1	5	--
Calcite (ornamental only)	2	--	--	2	--
Celestine kilograms	32,462	19,586	29,532	24,846	22,758
Citrine, gem do	18	47	NA	7	8
Cordierite do	4,500	49	(3)	158	154
Garnet:					
Gem do	6	NA	9	5	1,166
Other ornamental do	1,876	NA	616	1,251	
Jasper do	1,730	8,850	1,030	2,930	2,305
Labradorite do	7,646	4,389	7,504	7,500	24,806
Quartz:					
Rose quartz do	92,450	29,019	64,800	39,683	84,460
Geodes do	600	NA	--	950	57
Other ornamental do	1,516	547	3,515	1,299	21,649
Rhodonite do	3,335	--	--	11,990	350
Tourmaline:					
Gem do	NA	NA	1,563	734	1,745
Other ornamental do	68,000	NA	1,915	1,134	
Graphite, all grades	17,412	15,727	16,625	14,242	12,252
Mica, phlogopite:					
Block	7	NA	NA	61	84
Splittings and sheet	62	1,498	1,566	1,106	1,647
Scrap	12	NA	NA	NA	NA
Total	81	NA	NA	NA	NA
Nickel, mine output metal content	--	--	NA	NA	100
Quartz, piezoelectric kilograms	89	115	200	52	167
Salt, marine	27,300	26,000	30,000	e30,000	e30,000
Stone:					
Calcite, industrial	3,215	46,915	303	1,973	e2,000
Marble, cipoline	29,700	12,000	2,136	4,017	470
Quartz, metallurgical	107	NA	NA	NA	NA
Other: Bastnasite kilograms	10	19,586	NA	22,313	e23,000
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	920	826	796	478	e500
Kerosine and jet fuel do	482	425	365	275	e300
Distillate fuel oil do	1,160	912	761	502	e500
Residual fuel oil do	554	1,419	1,123	1,151	e1,200
Other do	81	59	87	44	e50
Refinery fuel and losses do	1,123	404	428	r e335	e350
Total do	4,320	4,045	3,560	2,785	e2,900

eEstimated. pPreliminary. rRevised. NA Not available.

[1]Table includes data available through Sept. 16, 1981.

[2]In addition to the commodities listed, opal and modest quantities of unlisted varieties of crude construction materials, (clays, stone, and sand and gravel) presumably are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Less than 1/2 unit.

Table 2.—Madagascar: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Destinations, 1977	
			United States	Other (principal)
METALS				
Chromium: Chromite	117,414	116,232	--	Japan 66,281; France 41,851.
Copper metal including alloys:				
Unwrought and scrap	r87	--		
Semimanufactures, kilograms	(1)	271	NA	NA.
Iron and steel metal, all forms	7	161	4	West Germany 76; Belgium-Luxembourg 31.
Lead oxides and hydroxides	119	139	--	All to Mozambique.
Zinc metal including alloys, all forms	25	--		
Other:				
Ores and concentrates	r1	4	--	Australia 2; Italy 2.
Base metals including alloys, all forms kilograms	272	10	NA	NA.
NONMETALS				
Abrasives, n.e.s.: Natural	1	4	NA	Mainly to West Germany.
Diamond, all grades carats	20,000	35,000	--	All to Austria.
Feldspar, leucite, nepheline	--	1	--	All to West Germany.
Graphite, natural	16,370	17,003	4,312	United Kingdom 7,456; West Germany 2,409.
Gypsum and plaster kilograms	--	80	NA	NA.
Mica, all forms	845	2,045	25	Japan 919; Belgium-Luxembourg 715; Poland 200.
Pigments, mineral: Natural kilograms	27	51	NA	NA.
Precious and semiprecious stones, except diamond do	489,292	252,602	969	Japan 99,847; West Germany 91,551; France 50,097.
Salt and brine	1,845	2,671	NA	NA.
Stone, sand and gravel	140	115	(2)	Mainly to West Germany.
Sulfuric acid kilograms	r150	537	NA	NA.
Other, crude do	r10	--		
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, 42-gallon barrels	281,046	33,436	NA	NA.
Kerosine do	121,345	11,666	NA	NA.
Distillate fuel oil do	172,675	12,138	NA	NA.
Residual fuel oil do	909,143	798,460	NA	Spain 196,902; Singapore 188,973; Bermuda 174,007.
Lubricants do	1	73	NA	NA.
Other:				
Liquefied petroleum gas do	5,660	12	NA	NA.
White spirit do	396	--		
Bituminous mixtures do	--	58	NA	NA.

rRevised. NA Not available.
1Revised to zero.
2Less than 1/2 unit.

Table 3.—Madagascar: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	8	6	NA	China, mainland 4; West Germany 1.
Metal including alloys, all forms	896	882	(1)	France 672; Greece 88.
Arsenic oxides and acid	2	4	--	China, mainland 2; France 2.
Chromium oxides and hydroxides	(1)	1	--	Mainly from West Germany.
Cobalt oxides and hydroxides kilograms	15	50	--	All from France.
Copper metal including alloys, all forms	3	87	(1)	Mainly from France.
Gold metal including alloys, unwrought and partly wrought troy ounces	1,190	15,111	--	All from France.
Iron and steel metal:				
Scrap kilograms	r173	--		
Pig iron, ferroalloys, similar materials	r39	17	--	Mainly from France.
Steel, primary forms kilograms	39	11	--	All from France.
Semimanufactures	r23,964	39,699	151	France 20,084; Japan 11,982; Mozambique 2,884.

See footnotes at end of table.

Table 3.—Madagascar: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides and hydroxides	2	8	--	France 6; Belgium-Luxembourg 2.
Metal including alloys, all forms	239	368	--	Mainly from France.
Magnesium metal including alloys, all forms —kilograms	27	1	--	All from West Germany.
Manganese oxides —do	80	2	--	France 1; West Germany 1.
Mercury —76-pound flasks	7	6	--	Mainly from West Germany.
Nickel metal including alloys, all forms —kilograms	36	28	--	France 23; West Germany 5.
Phosphorus, elemental	7	7	--	Hungary 5; East Germany 2.
Platinum-group metals including alloys, unwrought and partly wrought —troy ounces	--	386	--	France 193; West Germany 193.
Silver metal including alloys, unwrought and partly wrought —do	8,327	13,407	3,858	France 9,549.
Tin:				
Oxides and hydroxides —kilograms	100	3	--	West Germany 2; France 1.
Metal including alloys, all forms	8	10	--	France 7; Malaysia 2.
Titanium oxides	10	29	--	France 15; Belgium-Luxembourg 14.
Uranium and thorium oxides including rare-earth oxides —kilograms	--	44	--	All from West Germany.
Zinc:				
Oxides and hydroxides	11	8	--	France 4; West Germany 2; U.S.S.R. 2.
Metal including alloys, all forms	444	239	--	Mainly from France.
Other:				
Ores and concentrates —kilograms	96	85	--	All from France.
Oxides and hydroxides	7	7	--	Mainly from France.
Metals:				
Metalloids —kilograms	r103	2	--	France 1; West Germany 1.
Alkali, alkaline-earth, rare-earth metals —do	475	2,932	--	Mainly from United Kingdom.
Pyrophoric alloys	2	11	--	France 6; Austria 2; China, mainland 2.
Base metals including alloys, all forms	14	9	--	Belgium-Luxembourg 6; Netherlands 3.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	2	13	--	France 7; West Germany 6.
Dust and powder of precious and semi-precious stones —kilograms	53	200	--	Mainly from France.
Grinding and polishing wheels and stones	44	52	(1)	France 39; Italy 6; West Germany 3.
Asbestos crude	3	6	--	Mainly from France.
Barite and witherite	15	--		
Boron materials:				
Crude natural borates	41	40	40	
Oxide and acid	r(1)	6	1	China, mainland 5.
Cement, hydraulic	23,892	38,473	--	Mozambique 10,343; Kenya 10,074; North Korea 10,000.
Chalk	153	132	--	All from France.
Clays and clay products:				
Crude clays	r17	214	--	West Germany 195; Japan 19.
Products including nonclay refractory brick	437	803	--	France 373; Italy 184; West Germany 102.
Diamond, all grades —thousand carats	--	105	--	France 100; West Germany 5.
Diatomite and other infusorial earths	4	17	7	France 7; Hong Kong 3.
Fertilizer materials:				
Crude and manufactured:				
Nitrogenous	2,105	2,516	--	France 1,333; West Germany 813; Netherlands 349.
Phosphatic	3,389	2,276	75	Norway 1,550; Belgium-Luxembourg 372; Netherlands 248.
Potassic	7,552	4,348	--	Belgium-Luxembourg 3,351; France 686.
Other including mixed	1,072	2,885	130	France 2,063; Netherlands 560.
Ammonia	43	21	--	France 16; West Germany 2; Japan 2.
Graphite, natural —kilograms	r53	2	--	All from West Germany.
Gypsum and plasters	2,064	2,240	--	Mainly from France.
Lime	r1,130	1,294	--	France 1,092; Belgium-Luxembourg 202.
Magnesite	3	1	--	All from France.
Mica, all forms	4	(1)	--	Do.
Pigments, mineral, including processed iron oxides	29	43	--	France 27; West Germany 15.
Precious and semiprecious stones, excluding diamond —kilograms	--	18,678	2	Mainly from France.

See footnotes at end of table.

Table 3.—Madagascar: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
NONMETALS —Continued				
Salt and brine	17	16	--	West Germany 10; France 5.
Sodium and potassium compounds, n.e.s	2,650	2,714	2	West Germany 1,960; France 599.
Stone, sand and gravel:				
Dimension stone	5	7	--	All from Hong Kong.
Gravel and crushed rock	8	16	--	All from France.
Quartz and quartzite	--	15	--	Mainly from Hong Kong.
Sand excluding metal-bearing	9	1	--	All from France.
Sulfur:				
Elemental, all forms	11	9	--	Mainly from France.
Sulfur dioxide	2	2	--	Do.
Sulfuric acid, oleum	165	144	--	France 100; Netherlands 43.
Talc, steatite, soapstone, pyrophyllite	8	14	--	Mainly from France.
Other:				
Crude	879	428	--	All from France.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	(1)	2	--	Mainly from West Germany.
Bromine, iodine, fluorine kilograms	r411	477	--	West Germany 421; France 40.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	202	424	--	Mainly from France.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black and gas carbon:				
Carbon black	5	4	--	All from France.
Gas carbon	212	--		
Coal, all grades, including briquets	21,554	16,798	--	Mainly from Mozambique.
Coke and semicoke	103	110	--	All from France.
Hydrogen, helium, rare gases	1	3	--	Do.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	4,196	3,369	--	Iraq 2,245; Qatar 760; United Arab Emirates 364.
Refinery products:				
Gasoline[2] 42-gallon barrels	r21,733	62,841	--	Iran 44,510; Bahrain 16,935.
Kerosine and jet fuel do	r474	26,830	1	Kuwait 17,735; Bahrain 5,353; Iran 3,663.
Distillate fuel oil do	r3,172	48,305	--	Bahrain 39,708; Iran 6,355; Kuwait 2,049.
Lubricants do	r10,074	8,297	344	France 6,176; Italy 1,249.
Other:				
Liquefied petroleum gas do	r16	3,669	(1)	Mainly from Singapore.
Mineral jelly and wax do	r26,738	40,449	--	Japan 29,240; Indonesia 7,714.
Pitch and pitch coke do	129	244	--	All from France.
Bitumen and other residues do	18,695	62,364	NA	NA.
Bituminous mixtures do	26,735	718	--	Mainly from France.
Unspecified do	r109	24,751	--	Do.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r108	107	--	France 71; West Germany 35.

rRevised. Not available.
[1]Less than 1/2 unit.
[2]Includes white spirit.

COMMODITY REVIEW

METALS

Chromite.—Kraomita Malagasy continued to control the two operating chromite mines in Madagascar during 1980. The combined maximum production capacity of the mines were estimated at 215,000 tons per year. The Andriamena Mine was estimated to have an annual capacity of 175,000 tons, and reserves were estimated to contain 4 million tons of concentrates. The Andriamena ores graded 48% on the average, and were concentrated prior to shipment. The Befandriana Mine capacity was estimated at 40,000 tons per year, and identified resources were estimated at 250,000 tons. The higher quality Befandriana ores were fine and friable and did not require processing prior to exportation.

Transportation inadequacies continued to

result in overall production efficiencies of less than 80% during the year. Approximately 75% of the chromite produced in Madagascar found its way to international markets during 1980. Andriamena chromite production was trucked over a 90-kilometer asphalt road to a railhead at Morarano. The ore was then transferred to 30-ton capacity rail wagons to the port of Tamatave. The rail line was subject to washouts, derailments, and other problems. The Befandriana ores were transported by truck to Narinda Bay on the Northwest coast, loaded onto pontoon barges, and towed out to ships in the Bay. Both routes were limited by inadequate storage and loading facilities, and the total transport costs were very high.

An experimental ferrochrome plant was expected to be set up in Andriamena, with financial backing from the European Investment Bank (EIB). If the pilot test were determined successful, a ferrochrome facility would be designed and constructed at a 60,000-ton-per-year capacity. The Andekaleka hydroelectric plant, under construction during 1980, was expected to be the source for the energy-intensive processing plant.

Iron Ore.—Field studies continued on the Soalala iron ore deposits during 1980. The deposits were estimated to contain 300 million tons of ore reserves, with iron content ranging from 25% to 60%. Details of the known iron-ore resources in Madagascar appear in table 4.

Table 4.—Iron ore resources in Madagascar, 1980[1]

Deposit	Location	Type of ore	Principal mineral	Iron content (million tons)	Estimated reserves potential (million tons)
Ambatory-Analamy	Moramanga	Residual Lateritic	Goethite Hematite	46	38
Betioky	Betioky	Residual Lateritic	Goethite Hematite	24	30
Bekisopa	Fianarantsoa	Magnitnaya	Magnetite	40	70
Fasintsara	Ambostra	Lake Superior.	Magnetite, Hematite.	35	105
Marorangata-Ambatoloana	Tananarive	Lake Superior	Magnetite, Hematite.	25	8
Soalala	Kizomby	Lateritic	--	60	300
Total	--------	--------	-------- --------		551

[1] Mineral Raw Materials in Africa Iron Ore. Paper presented at the Regional Conference on the Development and Utilization of Mineral Resources in Africa, United Nations Economic Commission for Africa, Tanzania, Aug. 15, 1980, E/CN.14/Min.89/31, pp. 28-39.

Source: United Nations Economic and Social Council.

Feasibility studies conducted over a 2-year period were expected to include extensive drilling and metallurgical studies. Investigations were initiated by Madagascar's Mining and Industrial Board and Italsider S.p.A. (Italy). The financing was handled through the European Development Fund, together with Italian and French bilateral assistance programs. A European consortium of steelmakers were reported to be interested in exploiting the Soalala deposits.

Other.—Bauxite deposits studied during the last decade estimated conditional resources of 70 million tons at Manantenina, grading 40% Al_2O_3 and over 40 million tons at Marangaka, grading 38% Al_2O_3. The Government Geologic Service revealed that the bauxite was of the crystalline type and was of a high iron content. Softened world demand for this type of ore and large infrastructure costs associated with development of the deposits have inhibited exploitation.

Nickel ore deposits were identified in the Moramanga area of eastern Madagascar and were examined during 1980. North Korea and Madagascar signed an agreement to develop the resource at a projected rate of 150,000 tons per year. Plans were made to construct a refinery that would draw energy from the Andekaleka hydroelectric complex.

NONMETALS

Cement.—In 1980, Madagascar imported approximately 180,000 tons of cement out of the 245,000 tons required by domestic industries. E. S. Cement d'Antsirabe planned to

construct facilities to makeup for the shortfall. The new projects being considered were a 580,000-ton-per-year cement plant at Mahajanga, a 115,000-ton-per-year plant at Ibity, and a 500,000- to 1,000,000-ton-per-year plant at Soalara-Toliara.

Technical studies were completed and commerical agreements were made in 1980 for the Mahajanga plant. The facility was expected to utilize coal from Sakoa, and substantial quantities of the product were expected to be exported to the Middle East. Investments worth approximately $95 million were expected to be shared by Spain, while the bulk of the financing was expected to be furnished by an unnamed Arab country. The Soalara-Toliara cement plant was in the planning phase by yearend 1980.

A cement facility was under construction at Antsirabe during 1980. The 115,000-ton-per-year plant was estimated to cost $4.5 billion and was projected to be operational in 1982. A vertical kiln design was envisioned, with future expansion capability projected at 180,000 tons per year.

Fertilizer Materials.—The Ze-Ren fertilizer project, a joint venture between Madagascar and N-Ren International (United States), entered the construction phase during 1980. The engineers and contractors were Dominion Bridge and N-Ren International, and the Haldor Topsoe process was expected to be employed. The production of a total of 100,000 tons per year of ammonia and urea was expected, with a startup date of 1982.

Graphite.—Madagascar's graphite deposits occur in micaceous gneiss and schist and extended throughout the eastern half of the island. Resources were estimated to be very large, grading 3% to 10% graphite. About two-thirds of the conditional resources were classified as large flake and one-third was fine flake graphite.

Total graphite production decreased by approximately 28% in 1980 to 12,000 tons. There were five major private producers of flake graphite by yearend 1980. The Gallois Mines, owned by Etablissements Gallois (France), produced slightly over one-half of the total output. The interest of Société Lyonnaise Agricole Minière et Industrielle, one of the private producers of graphite, were taken over by a company owned by Sweden—Société Minière de la Grande Ile. Approximately 25% of the graphite produced in 1980 was attributed to this company. Another independently owned and operated facility at the Sahanavo Mine shut down operations during the second half of 1980.

Mica.—The total output of mica increased substantially during 1980. Mica exports doubled the levels reported in 1979 to approximately 1,500 tons. Four mines located at Ampandrandava, Benato, Ambararata, and Sakamasy were producing mica during 1980. Three private companies operated these productive mines in the southern part of Madagascar; Société Minière de la Grande Ile, Société des Mines d'Ampandrandava (SMGI/SOMIDA group) and the Fils de Jenny Co.

MINERAL FUELS

Coal.—Madagascar's known reserves of coal were estimated at 500 million tons in 1980, of which approximately 60 million tons were classified as steaming-grade coal. Most of the reserves were located within the Sakoa deposit in southwest Madagascar. An easily accessible outcrop of the Sakoa reserves were estimated to contain 40 million tons, and pilot exploitation was expected to begin sometime during 1981.

Investigations of the coal deposits continued throughout 1980 and focused on transportation and marketing aspects, as well as the project's overall energy and economic worth. A protocol was signed in 1980 by a Yugoslav construction and industrial company to develop Madagascar's coal mining. Specifics of the agreement were unknown by yearend 1980. The initial development of the Sakoa coal reserves, including necessary infrastructure, was projected to be very large. The construction of a new port at Toliara and a railroad connecting the deposit to the coast were under consideration.

Petroleum.—Exploration of petroleum, indigenous tar sand, and bituminous shale deposits were undertaken by various international organizations between 1964 and 1975. After the 1975 nationalizations, the National Military Office for Strategic Industries (OMNIS) became responsible for hydrocarbon exploration and eventual exploitation. The Malagasy Petroleum Co. was responsible for pricing and distributing imported petroleum supplies. Late in 1980, a new national hydrocarbons firm, AKORAMA, was proposed. OMNIS was to remain the chief shareholder of the new organization. AKORAMA was expected to be the executive organ of the State, charged with research, exploitation, and transportation of hydrocarbons.

The Karoo sediments located in the western part of the island, contain sizable resources of oil equivalents in the Morondava (southwest) and Majunga (northwest) Basins. The Bemolanga tar sands, also called bituminous sandstones, and the Tsimiroro heavy oil deposits lie within the Morondava Basin. Bituminous sandstone reserves were estimated at 2 to 3 billion tons, and heavy oil reserves were estimated at 9 billion tons. The Bemolanga deposits were estimated to contain the equivalent of 27 billion barrels of oil in approximately 400 square kilometers. The total area of possible oil and gas extends approximately 200,000 square kilometers within the Morondava Basin and 110,000 square kilometers within the Majunga Basin. The ratio of possible offshore to onshore deposits within the two basins were 67% and 57%, respectively, indicating that the majority of the combined possible oil-bearing sites were located onshore.

The International Development Association of the World Bank granted $12.5 million in credit to support petroleum exploration efforts during 1980. The project provided for consulting services in geological exploration and law. Madagascar was expected to contribute $2.1 million toward the cost of the project. The EIB loaned Madagascar $170 million in 1980 to exploit 3 billion tons of the bituminous sandstone deposits. Approximately 17% of the deposit was determined to be extractable by opencast mining, for the eventual annual production of 200,000 tons of synthetic petroleum products.

The Klöckner Industrie Anlagen of Duisburg (Federal Republic of Germany) conducted laboratory tests on the bituminous samples, utilizing the Lurgi conversion process. Results of the analyses were not made public by yearend 1980. OMNIS was planning to operate a pilot plant in northwest Madagascar and undertake an intensive drilling program during 1981. The petroleum refinery in Tamatave, which was rated at 9,670 barrels per day, continued to operate in 1980, and plans were made to construct another refinery at Tor Masina. Details of the pilot plant and new refinery were not available by yearend 1980.

Uranium.—A cooperative agreement between OMNIS, the United Nations Development Program and the International Atomic Energy Agency to evaluate uranium prospects over a 3-year period, made progress during the first full year of 1980. Metamorphic and sedimentary formations were investigated in the Fort Dauphine region, southern Madagascar, and in Antsirabe, south of the nation's capital, Antananarivo. OMNIS concluded an agreeement with the Croation Construction and Industrial Complex (Yugoslavia) during 1980, to survey and exploit uranium deposits near Tolagnaro. Under the agreement, a group of Yugoslavian technicians and engineers were to conduct field work in southern Madagascar.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary values have been converted from Malagasy francs (FMG) to U.S. dollars at a rate of FMG211 = US$1.00 in 1980.

The Mineral Industry of Malaysia

By John C. Wu[1]

The mining industry is and will continue to be an important sector of Malaysia's economy. Although the mining sector (nonfuel) contributed only 5% to the gross domestic product (GDP) of Malaysia in 1979, mineral exports of tin alone amounted to US$1 billion, or 9.1% of Malaysia's overall export earnings (US$11 billion) in 1979.[2] Other mineral exports of Malaysia were copper, bauxite, and byproduct minerals such as ilmenite, monazite, and zircon. Malaysia remained the world's largest tin producer in 1980. Its production constituted over 35% of the world's total tin supply. A joint-venture agreement between Malaysia Mining Corp. and the Selangor State Government worth US$91 million was signed in 1980 to develop the Kuala Langat deposit with an estimated tin reserve of 139,000 tons. The project is expected to come onstream in 1985, with an initial output of 2,200 tons of tin concentrate per year, gradually increasing to 3,000 tons per year after 1988.

In the mineral fuel sector, Malaysian oil reserves are less significant by world standards; however, Malaysia's nonassociated natural gas reserves will become important to the world in the 1980's. The newly discovered natural gasfield off the State of Trengganu, along the east coast of peninsular Malaysia, is larger than the Bintulu Gasfield of Sarawak, where the gas reserves are estimated at 10 to 14 trillion cubic feet. Malaysia will become one of the world's largest liquefied natural gas (LNG) producers, when the US$1 billion Bintulu LNG plant comes onstream in 1983.

Malaysia's crude oil exports are currently the second largest commodity export earner after rubber. In 1979, crude oil export earnings were valued at US$1.8 billion, or 16.4% of Malaysia's total export earnings. Output of crude oil rose 30% to 283,000 barrels per day in 1979 from 217,000 barrels per day in 1978. However, the Government of Malaysia, in an effort to conserve its oil reserves, in June 1980 began to enforce the National Petroleum Depletion Policy, which allowed Petronas, the State-owned oil and gas company, to regulate the overall oil production to average 270,000 barrels per day in 1980, and to reduce production to 260,000 or 250,000 barrels per day in later years.

Malaysia's GDP grew 8.3% in real terms between 1978 and 1979. A 7.7% real growth in Malaysia's GDP was estimated for the 1979-80 period. Malaysia's real GDP in 1980 was estimated at US$13.2 billion. This growth of Malaysia's economy was sustained largely by economic expansion in domestic demand and by favorable but weakening export earnings. Production in the agriculture, manufacturing, construction, and service sectors increased in 1980. Output in the mining sector, however, declined slightly as a result of lower production of tin and crude oil. Export earnings also slowed slightly owing to the lower level of economic activity of industrial countries, which in turn has weakened the overseas markets of some of Malaysia's export commodities. The export earnings of tin and crude oil remained high because of higher prices for oil and raw materials. Malaysia's imports of machinery, transport equipment, chemical commodities, and manufactured goods continued to grow in 1980. The higher gross imports were stimulated by the strong expansion in domestic demand for the intermediate goods. The overall balance of trade in 1980 was estimated as a favorable trade surplus of US$3.1 billion, only slightly lower than that of 1979.

In formulating a national mineral policy to encourage mineral exploration, a new National Mining Code was introduced by the Government to streamline procedures and policies related mainly to land use. The code was comprised of two acts: A National Mining Act, covering the issue of mining rights; and a Mines Control Act, regulating the mining operations. However, the joint Federal-State National Land Council reportedly has rejected the draft National Mining Code. The opposition came mainly from the State governments, which insist on preserving their rights over mining lands.

PRODUCTION

In 1980, most of Malaysia's mineral production declined except copper, bauxite, and clay. Crude oil production estimated for 1980 was 100.4 million barrels at an average of 275,000 barrels per day compared with 283,000 barrels per day in 1979. This was owing to the production cutback mandated by the National Petroleum Depletion Policy to conserve Malaysia's limited oil reserves. The tin-in-concentrates produced during the first 9 months of 1980 totaled 46,229 tons, a decrease of 2.2% from 47,289 tons produced during the same period of 1979. The lower level of tin output reflected the declining grade of existing ore bodies. Despite the favorable prices of tin, Malaysia's tin miners were unable to boost their production in 1980, because of the higher cost of production, especially the energy costs. Iron ore production in the first 9 months of 1980 declined 3.2% compared with output in the comparable period of 1979, from 258,664 tons to 250,452 tons. Copper concentrate production for the first 9 months, however, registered a 6.2% gain from 79,441 tons in 1979 to 84,336 tons in 1980. The only significant gain in the mining sector for 1980 was in bauxite mine production, which was 700,514 tons during the first 9 months of 1980 compared with 249,522 tons during the same period of 1979. This spectacular increase was due to the opening of an additional mine in Johore. Malaysia's china clay production increased 45.2%, from 24,891 tons for the first 9 months of 1979 to 36,134 tons for 1980.

Table 1.—Malaysia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum: Bauxite, gross weight thousand tons	660	616	615	387	920
Antimony, mine output, metal content (Sarawak)	250	r264	291	307	133
Columbium and tantalum concentrate, gross weight	46	45	23	40	33
Copper, mine output, metal content (Sabah)[e 3]	18,200	23,000	26,400	23,600	25,700
Gold, mine output, metal content:					
Malaya troy ounces	3,574	4,172	5,805	5,273	4,621
Sarawak do	964	742	971	1,062	379
Total do	4,538	4,914	6,776	6,335	5,000
Iron and steel:					
Iron ore and concentrate thousand tons	308	330	320	350	371
Crude steel do	190	194	203	233	e220
Manganese ore and concentrate, gross weight	94,112	45,396	42,721	31,605	4,003
Rare-earth metals, gross weight:[4]					
Monazite	1,879	1,977	1,263	669	e420
Xenotime (yttrium mineral)	139	75	--	NA	NA
Silver, mine output, metal content (Sabah) thousand troy ounces	e300	e430	482	e450	e490
Tin:					
Mine output, metal content	63,401	58,703	62,650	62,995	61,404
Metal, smelter[5]	r77,297	r66,304	71,953	73,068	71,318
Titanium: Ilmenite concentrate, gross weight[4]	179,995	153,666	186,816	199,819	e180,000
Tungsten, mine output, metal content	64	99	72	53	37
Zirconium: Zircon concentrate, gross weight[4]	3,129	1,810	927	1,271	e400

See footnotes at end of table.

Table 1.—Malaysia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS					
Barite	6,096	11,074	5,079	1,401	--
Cement, hydraulic thousand tons	1,739	1,777	2,196	2,265	[e]2,500
Clay: Kaolin	26,252	31,856	31,174	32,934	46,324
Nitrogen: N content of ammonia	42,700	34,000	39,800	52,000	41,100
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural (Sarawak):					
Gross million cubic feet	104,728	95,850	85,121	105,623	[e]115,500
Marketed do.	22,611	32,755	35,624	39,528	[e]45,000
Petroleum:[6]					
Crude thousand 42-gallon barrels	60,547	66,984	79,171	103,296	100,404
Refinery products:					
Gasoline do.	6,210	6,733	7,517	[e]9,000	NA
Jet fuel do.	1,550	1,203	1,445	[e]1,700	NA
Kerosine do.	2,050	2,436	2,311	[e]2,800	NA
Distillate fuel oil do.	8,900	9,695	11,078	[e]13,000	NA
Residual fuel oil do.	10,560	14,405	15,912	[e]19,000	NA
Other do.	4,760	4,809	4,614	[e]5,500	NA
Refinery fuel and losses do.	510	675	738	[e]900	NA
Total do.	34,540	39,956	43,615	[e]51,900	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]All production is from peninsular Malaysia (Malaya) unless otherwise specified. Table includes data available through July 30, 1980.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone), salt, and fertilizers are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Estimates based on exports of copper concentrates.

[4]Based on export figures.

[5]Includes small amounts of tin from the smelter in Singapore.

[6]Includes production from Malaya and Sarawak.

TRADE

Tin and crude petroleum of the mineral sector, along with rubber, sawed logs and timber, and processed palm oil of the agricultural sector, remained by far the major export earners of Malaysia.

In 1979, tin exports earned US$1 billion in foreign exchange, and crude and partly refined petroleum earned US$1.9 billion. Tin and petroleum accounted for 26.4% of Malaysia's overall foreign exchange earned in 1979 and remained substantially the same in 1980.

The main buyers of Malaysia's tin in 1979-80 were Japan, the Netherlands, the United States, the U.S.S.R., Italy, and India. The major importers of Malaysia's crude oil were Japan, Singapore, the United States, the Philippines, and Thailand.

Malaysia's gross major imports in 1979 were machinery and transport equipment, valued at US$2.9 billion; manufactured goods, valued at US$1.3 billion; and mineral fuels, valued at US$938 million. These three major imports accounted for over 65% of the value of overall gross imports in 1979 and about the same in 1980.

The main supplying countries of Malaysia's major imports in 1979-80 were Japan, the United States, Singapore, the Federal Republic of Germany, the United Kingdom, and Australia.

Malaysia imported most of its mineral fuels from Saudi Arabia, Singapore, and Kuwait. The reasons for Malaysia to import substantial volumes of mineral fuels are (1) it is more profitable for Malaysia to export its lighter crude and import the heavier crude from other countries, (2) Malaysia's refineries were designed to process a mixed crude, using 70% imported crude and 30% Malaysian crude to produce the domestic requirement of refined products, and (3) Malaysia's existing refining capacity could not meet the growing domestic demand for the refined products.

During the 1979-80 period, Malaysia's major trading partners, based on the overall value of two-way trade, were Japan, the United States, Singapore, Australia, the United Kingdom, and the Federal Republic of Germany.

COMMODITY REVIEW

METALS

Aluminum.—Two bauxite mines are currently operating in the Pengerang area (Telok Ramunia Mine) and the Johore area (Sri Medan Mine) of the southern portion of peninsular Malaysia. The ore from Pengerang is essentially derived from volcanic material and to a lesser extent from sediments and granite-micropegmatites. The ore reserves in the Pengerang area are estimated at 9 million tons, and should last for another 15 years at the current rate of production.

The total bauxite production was down substantially in 1979 since only one mine was in operation during the first 7 months of 1979. During the third quarter of 1979 to the third quarter of 1980, production was at a much higher level with two mines operating. Most of Malaysia's bauxite was exported to Japan. Malaysia's exports of bauxite were valued at US$6.1 million, up 22% from US$5.0 million in 1978.

A US$27 million, 180,000-ton-per-year aluminum smelter complex planned for Sabah was shelved in September 1980, because there was not enough natural gas in the area to generate the required electric power for the proposed smelter.

Copper.—The only copper producer of Malaysia, Overseas Mineral Resources Development Sabah Bhd (OMRDS), operates an open pit porphyry copper mine at Mamut in the foothills of Mount Kinabalu, 70 miles from the State capital of Sabah, Kota Kinabalu. Copper deposits in the Kinabalu area are a low-grade porphyry type associated with tertiary adamellite-granodiorite intrusions. At the Mamut Mine, the ore reserves are estimated at 77 million tons, with an average grade of 0.608% copper and associated gold and silver content. Mining and production of copper concentrates started in 1975. In 1980, the production of copper concentrate was near full capacity at a rate of 9,200 to 10,000 tons per month. For the fiscal year ending March 1980, the company for the first time earned a pretax profit, which amounted to US$6 million. This was largely due to the extraction of 2 tons of gold and 12 tons of silver which were valued at US$28 million. Malaysia exported most of its copper ore and concentrates to Japan. OMRDS has been exporting about 90,000 to 100,000 tons of copper concentrates to Japan each year, which accounted for 3% to 4% of Japan's annual consumption.

OMRDS, a joint-venture company, was originally owned by Overseas Mineral Resources Development of Japan (51%) and Malaysia's local private interests (49%). In mid-1980, the Sabah State government acquired all of the 49% interests from the local stockholders, through the State Economic Development Corp., and there was speculation that the State planned to acquire a majority interest in OMRDS. The Sabah Government was also interested in building a US$136 million copper smelter with an annual capacity of 60,000 to 100,000 tons of copper, and the acquisition of the local shareholders' 49% interests was seen as a first move in setting up the smelter. A feasibility study of building the smelter was expected to be undertaken soon.[3]

Gold.—Gold in Malaysia is recovered as a byproduct of tin mining in the Bidor area of Perak and in the Kuala Lumpur area of Selangor. It is also produced by small-scale mining operations in the Raub area of Pahang and in the Bau mining district of Sarawak. In recent years, an appreciable quantity of gold was extracted from the Mamut copper mine in Sabah. In 1980, there were 10 small-scale gold mines operating in the States of Pahang and Sarawak.

As a result of a detailed 2-year ground survey by the Malaysian Government, with the cooperation of experts from the Canadian Industrial Development Authority, a number of gold deposits have been discovered in several areas in Ulu Kelantan. The areas where alluvial gold deposits were found are Gua Musang, Manik Urai, Sokor, Dabong, Sungai Pergau, and Sungai Galas. It was reported that the mining activities to extract the gold from the areas are expected to be carried out by a joint venture between the State Economic Development Corp. of Kelantan and a local mining firm.[4]

Iron and Steel.—Malaysia's iron ore output of 1980 increased slightly from the output of 1979. In 1980, there were 10 mines in operation. The largest mine, at Gunung Jerain in Kedah, produced 148,000 tons of iron ore, accounting for 40% of Malaysia's total output in 1980. The small-scale operations include one at Bukit Iban in Pahang, six in Perak, and two in Johore. Most of the

iron ore was consumed domestically by Malaywata Steel Bhd for its steel mill in Prai.

The Government of Malaysia announced in September 1980 that it will build a direct-reduction iron processing and electric furnace steelmaking complex at Teluk Kalong near Kemaman in the State of Trengganu. The total cost of the project is estimated at M$500 million (US$227.3 million). The complex would have an iron ore storage area, a sponge iron plant (projected cost US$151.7 million), an electric furnace steelmaking shop, a billet plant, and a steel rod producing plant. This steelmaking complex is expected to be operational in 1985.[5]

Malaysia's Amalgamated Steel Mills has awarded a contract to Danieli, an Italian plant maker, for the construction of what will be Malaysia's largest electric arc furnace steelworks. The plant includes a 70-ton electric furnace and a six-strand continuous billet caster. The furnace will be supplied by Tagliaferri, and Danieli will build the caster, which will supply the feed for the existing wire rod plant.[6]

Tin.—Malaysia was still the world's largest tin producer in 1980. The output of tin-in-concentrate for the first 9 months of 1980 was down slightly from the output of the same period in 1979. The number of active mining units at the end of September totaled 872, compared with 936 and 873 at the end of 1978 and 1979, respectively. Of the total tin concentrates produced by the end of September 1980, 56% was mined by gravel pumping, 30% by dredging, 4% by open casting, 2% by underground mining, and 8% by retreatment, dulang, and other methods.

Of the total number of tin production units active at the end of September 1980, 766 units were gravel pumps, 54 were dredges, 27 were opencasts, 20 were underground, and 5 were others. These active tin mines were operated mainly in the following States: 556 units in Perak, 181 in Selangor, 33 in Pahang, 30 in Johore, 21 in Kedah, 18 in Perlis, 17 in Trengganu, 8 in North Sembilan, and 8 in Malacca. Malaysia's tin industry employed a total of 39,720 persons at the end of September 1980. Over 85% of this total labor force was employed by gravel pumping and dredging mines concentrated in the States of Perak and Selangor.

The value of tin output accounted for an estimated 4.6% of Malaysia's GDP. Malaysia's tin exports were valued at M$2.3 billion (US$1 billion) in 1979, up 15% from M$2 billion (US$909 million) in 1978. Export earnings of tin for the first 9 months of 1980 were valued at M$1,934.2 million (US$879 million), up 12% from M$1,728.0 million (US$785 million) for the same period in 1979. Export duty imposed on tin provided for an estimated 5.4% of Malaysia's total Federal revenue in 1979.[7] Tin in Malaysia remains the fourth largest primary commodity export, following rubber, petroleum, and processed palm oil. In an effort to encourage increased tin production, the Federal Government of Malaysia introduced a two-part tax structure in October 1979. The two-part tax structure is basically a restructure of tin export duty, which is intended to encourage the development of the marginal tin mines affected by a decrease in tin price. A "cost plus" concept was used in this newly introduced duty structure which provided a reference average tin production cost of M$1,110 per picul. If the tin price exceeds M$1,400 per picul,[8] a 20% export duty will be imposed up to M$1,450 per picul; a 5% duty will be added for each M$50 per picul beyond M$1,450 per picul, up to a maximum export duty rate of 50%. On the other hand, the Federal Government of Malaysia amended the upper limit of tin profit tax from 12.5% to 15% when annual profit exceeded M$400,000.

Despite the introduction of this two-part tax structure, Malaysia's tin output remained stagnant over the 1979-80 period. The industry faces problems of high production cost, depletion of the exisiting mines, and inability to gain mining rights to new deposits. According to a recent estimate, Malaysia's established ore reserves on (or adjacent to) existing mining operations could provide for an average future mining life of only about 10 years at current output levels with an additional "possible ore reserves" to allow another 2 to 3 years of tin production.[9]

Malaysia Mining Corp. (MMC) reached a joint-venture agreement with Kumpulan Perangsang Selangor (KPS), the mining arm of the Selangor State government, on June 21, 1980, to develop the deep alluvial tin deposit at Kuala Langat in Selangor. According to the agreement, a new company called Kuala Langat Mining Serdinian Berhad will be established. KPS will have a 65% majority interest in the M$200 million (US$91 million) joint venture, while

MMC will own 35%. The agreement took 3 years of intense negotiation, and 10 years have passed since it was first proposed by Charter Consolidated Ltd., which discovered the Kuala Langat deposit in 1970.[10] Kuala Langat Tinfield is the second richest alluvial tinfield in Malaysia after Kinta Valley in Perak. The established reserves are estimated at 2.3 million piculs (139,100 tons) and the possible total reserves at 5 million piculs (302,400 tons). Much of the tin deposit lies under the Brooklands Estate, which covers 4,200 acres. The tin-bearing material is covered by overburden to a depth of 100 to 150 feet. The thickness of the tin ore body underneath the overburden ranges from 100 to 200 feet. The development of this Brooklands Estate represents the first phase of the entire Kuala Langat tin project. The Brooklands palm oil estate is owned by Plantation Holdings, and the Selangor State government has an agreement in principle to buy the land required for mining on a progressive basis. The first phase of the project is expected to come onstream in 1985 with the first dredge, which is estimated to cost US$23 million, in operation. Preliminary output during the first-phase operation for 1985-89 is projected as follows:

Year	Quantity of tin concentrates (metric tons)
1985	2,238
1986	3,205
1987	2,903
1988	2,963
1989	3,024

The second phase is expected to be completed in 1990 with at least three large dredges in operation, and the output level is expected to reach 6,000 to 7,000 tons of tin concentrates per year after 1990. The entire project is forecast to last 22 years.[11]

The significance of this new agreement is twofold. First, it tends to give new hope to the Malaysia tin industry, which in the last few years has been unable to lease new land or renew existing mining leases. Second, it will augment the country's dwindling tin production from the existing tin mines, which are facing depletion in 10 years.

MMC reportedly is negotiating with Datuk Kramat Holdings to acquire a majority interest in its 70,000-ton-per-year smelter after Straits Trading declined to offer MMC equity participation in its 60,000-ton-per-year Penang smelter. If the talks should fail again, MMC plans to build a tin smelter at Budit Rajah near Kelang in Selangor. The smelter would have an initial capacity of treating 20,000 tons per year of tin concentrates and refining 15,000 tons per year of tin metal. A prequalification invitation for tenders to construct a tin smelter has been issued by MMC in April 1980.

A new tin mining company, Modal Seri Pandan Sendirian Berhad (MSPS), was formed in Malaysia in early 1980. MSPS is a joint-venture company, owned 30% by Conzinc Riotinto Malaysia and 70% by the State government of Pahang. The company will mine a 3,000-acre alluvial plain for tin at Sungai Pandan, 10 miles northwest of Kuantan in Pahang. The joint-venture project will cost M$16 million (US$7.3 million). Production is expected to begin in 1982 and to last 25 years based on the estimated ore deposits in the area.[12]

In June 1980, an agreement for the merger of six tin mining companies was reached. Proposal for the merger was initiated by Malayan Tin Dredging. The companies involved were Malayan Tin Dredging, Southern Malayan Tin Dredging, Southern Kinta Consolidated, Kramat Tin Dredging, Lower Perak Tin Dredging, and Bidor Malaya Tin. These six companies have two things in common; MMC has a holding in each of them, and all their tin mines are in the State of Perak. One reason for the merger is to create a single State-based company which can simplify administration of the companies and make it easier to negotiate with the State government for gaining new mining rights or renewing leases.[13]

Titanium.—Ilmenite production in Malaysia is recovered as a byproduct of tin mining operations in alluvial deposits of peninsular Malaysia. Much of the ilmenite produced in Malaysia was exported. In 1979, total exports of ilmenite amounted to 199,819 tons, of which 187,165 tons went to Japan. For the first 9 months of 1980, total output of ilmenite was estimated at 94,300 tons. Mining of alluvial deposits of ilmenite in the Kampung Ajil area in Trengganu was initiated in the late 1970's, but owing to lack of water and excessive losses of ore during treatment, the mining project was dropped.

Other Metals.—Manganese ore production in Malaysia declined substantially from 1978 to 1979. Production of manganese

ore dropped to less than a quarter of the 1979 level and ceased in mid-1980. Other metallic minerals including columbite, monazite, scheelite, wolframite, xenotime, and zircon were recovered as byproducts of alluvial tin operations and from tailings of dredging operations in peninsular Malaysia.

Two significant uranium deposits have been discovered and identified in the Ulu area of Kelantan, 35 miles from the Thai border, and in an area near the Titiwangsa Range in Pahang. An aerial geophysical survey will be conducted by the Government of Malaysia in cooperation with the Canadian International Development Agency (CIDA). The experts from CIDA indicated that the "quality" matches that of Canadian deposits, based on the data obtained from a 2-year ground survey conducted in those two States.[14]

NONMETALS

Cement.—Total production capacity of Malaysia's cement industry in 1979 was 2.4 million tons. Actual production in 1979 and 1980 was near full capacity at 2.5 million tons. The second largest cement producer, Associated Pan Malaysia Cement Sd. Berhad, has undertaken an expansion program of its plant at Rawang. The expansion project involves replacement of the existing uneconomical wet-kiln operation with a 1.2-million-ton dry-process kiln complex. Blue Circle Group, an associated company of Associated Pan Malaysia Cement, provides technical and engineering services to the project. The expansion project was expected to be completed late in 1980.[15]

Fertilizer Materials.—Total chemical fertilizer production of Malaysia in 1979 was at about the same level as in 1978 at 320,000 tons. Production in 1980 was up 39%, based on the comparison of the first 9 months' production for 1979 and 1980. However, Malaysia still imported substantial amounts of fertilizer materials and manufactured chemical fertilizer to meet its domestic demand. In 1979, Malaysia imported a total of 935,592 tons of fertilizer valued at M$276 million (US$125.5 million). Imports of fertilizer for the first 9 months of 1980 were 708,264 tons, up 8.4% from 653,352 tons in the same period of 1979. The major overseas suppliers of Malaysia's fertilizer in 1979 were Togo, Jordan, Nauru, Banaba, and Christmas Island for phosphate rock; Indonesia, Romania, the U.S.S.R., and the German Democratic Republic for urea; Japan, the Republic of Korea, and Romania for ammonium nitrate and ammonium sulfate; and the United States for superphosphate.

In 1980, Albright and Wilson of Malaysia doubled the capacity of its high-quality thermal phosphate acid plant in Port Kelang. The company is the only producer of good-quality phosphoric acid in Southeast Asia. It not only supplied much of the Malaysia market, but exported 65% of its total production to other countries in 1979.[16]

Other Nonmetals.—Clays suitable for the manufacture of cement, brick, roofing tiles, and pottery are abundant in Malaysia. The ball clay used as raw material with kaolin in pottery bodies, wall and floor tiles, and chinawares was produced from alluvial tin mines and from the freshwater swamp in peninsular Malaysia. Kaolin has been mined at Bidor in Perak, at Semiling in Kedah, at Bukit Mertajam in Pahang, at Cheras and Rawang in Selangar, and at Jemalnang and Pontian in Johore. In 1980, mine production of kaolin (china clay) came from nine operating units in Perak, two units in Selangor, and two units in Johore. Kaolin production for the first 9 months of 1980 increased 45% to 36,134 tons, compared with 24,891 tons in the same period of 1979. The increase of kaolin mine production in 1980 was due to two additional operating units in Perak and one addition in Johore. Large kaolin reserves occur in the area of Bidor in Perak and in the area of Jemaluang in Johore.

Malaysia also produced limestone in Kelantan, Perak, Perlis, Pahang, Kedah, and Selangor. Presently, limestone is produced mainly for consumption by the domestic cement industry and is used as road metal and concrete aggregate.

MINERAL FUELS

Coal.—Coal resources in peninsular Malaysia are insignificant. However, a number of relatively significant low-grade coal deposits have been discovered in Sarawak. For example, in 1970 the coal deposits in the Silatek area of western Sarawak were discovered and identified by two Japanese companies to contain 1 million tons of coking coal, 4 million tons of anthracite, and 1.3 million tons of semianthracite. Utah Pacific Inc. has also discovered several coal deposits near the Bintula area of Sarawak in 1978. The areas identified by Utah Pacific to have economic potential are Sungai Segan, Kampung Jepak, Sungai Sepadok,

Sungai Sera, and Sungai Kelabat.

At present, there is no coal production in Malaysia. For the past few years, 15,000 to 20,000 tons of anthracite were imported annually, mainly from Indonesia, for domestic consumption. Malaysia's iron and steel industry also imported 15,000 to 20,000 tons of coking coal each year, mainly from Japan and Taiwan.

Natural Gas.—Petronas, the State-owned national oil and gas company, signed an agreement with Shell Royal/Dutch and the Sabah State government on July 31, 1980, to undertake two gas-related projects worth a total of more than M$1 billion (US$455 million). Under the agreement, Petronas and Shell will supply gas from three offshore fields in Sabah to the Sabah State government at the rate of 60 million cubic feet per day over a 20-year period for distribution to industries and other consumers. A liquefied petroleum gas plant will also be built at Labuan in Sabah to utilize gas produced in the Labuan area.

A natural gasfield off the coast of Trengganu State, discovered recently by Esso Production Malaysia, is estimated to be one of the world's largest nonassociated gasfields, having an economic life of 70 years. Although the quantities of reserves have not yet been confirmed, the gas reserves in the area are believed to be larger than those of Bintulu Gasfield in Sarawak.[17] Petronas, in cooperation with one of the major oil companies, will start further exploration work off the coast of Trengganu soon.

Malaysia will become one of the world's largest producers of LNG when the US$1 billion Bintulu LNG project comes onstream in 1983. Annual capacity is projected to reach 6 million tons in 1986. According to Petronas, the gas reserves in Sarawak are estimated at 10 to 14 trillion cubic feet.[18] Based on the latest publicly released figure by Petronas, Malaysia now has a total nonassociated gas reserve in excess of 30 trillion cubic feet.[19] In conjunction with the Bintulu LNG project, which was originally scheduled to come onstream in 1981, five LNG tankers were ordered by Malaysia International Shipping Corp. (MISC) in 1975, to be delivered in 1981 by a French shipyard. Since the Bintulu LNG project would not be completed until the end of 1983, the five tankers with a capacity of 13,000 cubic meters each would have to be leased out in the interim period. If the tankers were delivered on schedule and attempts to lease them out were unsuccessful, the only alternative would be to preserve them until 1983. However, an official of Malaysia indicated that despite their potential loss, these five tankers may in fact turn out to be a bargain owing to the cost differentials between 1975 and 1980.[20]

Petroleum.—Malaysia's production of crude oil reached a record high at 283,000 barrels per day in 1979 from a previous high of 217,000 barrels per day in 1978. Crude oil output in the first half of 1980 was reduced to 278,000 barrels per day. In line with Malaysia's National Petroleum Depletion Policy, which became effective on June 1, 1980, Petronas regulated crude oil output to 270,000 barrels per day in the second half of 1980 to slow depletion of its oil reserves. It is anticipated that the flow will be further cut to between 250,000 and 260,000 barrels per day later.[21] Malaysia's recoverable oil reserves were estimated in 1980 by Petronas at 1.8 billion barrels, which would be exhausted in 17 years at the present rate of production.

Malaysia exported about 90% of its crude oil produced in 1979. Export earnings from crude oil rose by 81% from M$2.2 billion (US$1 billion) in 1978 to M$4 billion (US$1.8 billion) in 1979, owing to the higher world prices. Much of Malaysia's crude oil was exported to Japan, Singapore, and the United States in 1979.

The Government of Malaysia, through Petronas, announced in October 1980 that it will build a M$300 million (US$136 million), 150,000-barrel-per-day refinery in the State of Melaka along peninsular Malaysia's southwestern coast, and a 30,000-barrel-per-day refinery in Trengganu on the eastern coast. The two refineries are scheduled to come onstream in 1984-85. It was reported that Kuwait had indicated interest in equity participation and had pledged to provide technical assistance in gas separation from extracted crude. The main reasons for selecting Melaka as the site for the larger refinery were that the project will help boost the industrialization programs of Melaka, which has poor land and natural resources, and that the refinery will be able to utilize the newly completed ocean port at Tanjong Kelling.[22]

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[1]Economist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Malaysian dollars (M$) to U.S. dollars at the rate of M$2.2=US$1.00.

[3]Standard Chartered Review (London). July 1980, p. 31.

[4]New Straits Times (Kuala Lumpur). June 2, 1980, p. 1.
[5]American Metal Market. Sept. 26, 1980, p. 4. Business Times (Kuala Lumpur). Sept. 24, 1980, p. 1.
[6]Metal Bulletin. May 13, 1980, p. 41.
[7]U.S. Embassy, Kuala Lumpur, Malaysia. Industrial Outlook Report-Minerals. CERP 0429, Apr. 14, 1980, pp. 1-2.
[8]The Malaysia Government raised the threshold price from M$1,200 per picul to M$1,400 in mid-December 1980.
[9]Mining Journal (London). V. 295, No. 7565, Aug. 15, 1980, p. 126.
[10]Charter Consolidated Ltd. has a 28.6% stake in MMC.
[11]Malaysia Tin Bureau. Tin News. Aug. 15, 1980, p. 2. U.S. Embassy, Kuala Lumpur, Malaysia. Joint-Venture Agreement Concluded on the Kuala Langat Tin Project. State Department Telegram 4206, June 27, 1980.
[12]Metal Bulletin Monthly. April 1980, p. 52. Engineering and Mining Journal. February 1980, p. 141.
[13]Metal Bulletin. June 20, 1980, p. 22.
[14]Engineering and Mining Journal. June 1980, p. 276; October 1980, p. 153.
[15]Rock Products. April 1979, p. 115.
[16]The British Sulphur Corp. Phosphorus & Potassium. No. 108, July/August 1980, p. 17.
[17]Far Eastern Economic Review. Aug. 22, 1980, p. 40.
[18]Petroleum News. June 1980, p. 80.
[19]Asia Mining. September 1980, p. 102.
[20]New Straits Times (Kuala Lumpur). Sept. 19, 1980, p. 1.
[21]The Asian Wall Street Journal. Aug. 5, 1980, p. 3.
[22]Petroleum News. November 1980, p. 28. Business Times (Kuala Lumpur). Oct. 14, 1980, p. 1.

The Mineral Industry of Malta

By Roman V. Sondermayer[1]

During 1980, exploratory drilling for oil by Texaco Inc. started on offshore Malta, but immediately problems were encountered with Libya. Although drilling was on Malta's continental shelf, a Libyan submarine and a missile-launching frigate approached the platform and forced the drilling to be stopped. The Libyan Government claimed that the drilling area was under Libyan, not Maltese, jurisdiction.

Libya's action evoked an angry reply by the Maltese Government, and the Libyan Government agreed to settle the border dispute in the International Court of Justice. The Government of Malta then ordered the companies to renew drilling operations in accordance with the license they obtained in 1974. Standard Oil Co. of Indiana declined, and its license was revoked, but Texaco subcontracted Ente Nazionale Idrocarburi (ENI), the Italian corporation, to drill a well 60 miles southeast of Malta. After further Libyan intimidation, drilling was abandoned by ENI, and by yearend it had not been resumed.

PRODUCTION

Table 1 shows the latest trends in production of minerals in Malta. The industry was mostly made up of small family-run enterprises.

Table 1.—Malta: Production of mineral commodities[1]

Commodity and unit of measure	1976	1977	1978	1979[e]	1980[e]
Lime ____ thousand metric tons__	27	32	28	30	31
Limestone ____ thousand cubic meters__	[2]962	[2]802	[e]386	400	400
Salt ____ metric tons__	290	797	600	500	550

[e]Estimated.
[1]Table includes data available through June 24, 1981.
[2]Figures represent reported output plus an estimate for quantitatively unreported output.

TRADE

Malta depended on imports of a number of mineral commodities, but all in small quantities.

Fuels were major import and export items; bunkering was the principal category of exports. Foreign mineral trade is shown in tables 2 and 3.

[1]Physical scientist, Branch of Foreign Data.

Table 2.—Malta: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Waste and scrap	87	90	--	Italy 73; United Kingdom 17.
Semimanufactures value	$101,127	$141,319	--	Italy $79,826; Libya $25,151; Saudi Arabia $16,554.
Copper metal including alloys:				
Waste and scrap	365	546	--	United Kingdom 116; Belgium 106; Spain 98; Netherlands 91.
Semimanufactures: Bars and rods value	$32,008	$16,026	--	All to United Kingdom.
Gold metal including alloys; bullion, unwrought troy ounces	4,144	--		
Iron and steel metal:				
Waste and scrap	9,351	3,441	--	Italy 3,056; Netherlands 351; Belgium 34.
Grit, shot, pellets	--	4	--	All to Italy.
Semimanufactures:				
Bars, rods, angles, shapes, sections value	$4,460	$298,974	--	Algeria $218,886; Libya $75,560; West Germany $3,157.
Universals, plates, sheets do	--	$60,542	--	Libya $33,493; United Kingdom $26,881.
Wire do	$6,234	$14	--	All to Italy.
Pipes, tubes, fittings do	$812,212	$190,442	$60,826	West Germany $128,536.
Lead metal including alloys:				
Waste and scrap	88	549	--	Italy 363; Belgium 165; United Kingdom 21.
Semimanufactures: Bars, rods, angles, shapes, sections value	$1,304	--		
Nickel metal including alloys:				
Waste and scrap kilograms	16,200	3,269	--	United Kingdom 2,719; West Germany 550.
Semimanufactures value	$48,673	$49,774	--	All to West Germany.
Silver metal including alloys, unworked or partly worked troy ounces	12,418	--		
Zinc metal including alloys:				
Waste and scrap	53	90	--	Spain 55; United Kingdom 35.
Semimanufactures: Plates and sheets value	--	$223	--	All to Dubai.
NONMETALS				
Abrasives, natural, n.e.s.:				
Emery, crude or crushed, and pumice do	$2,779	$340	--	All to Switzerland.
Dust and powder of precious and semi-precious stones do	$1,720	--		
Grinding and polishing wheels and stones do	$170,021	$275,071	--	Yugoslavia $202,592; Poland $40,728; Switzerland $30,066.
Cement	100	--		
Clays and clay products:				
Crude	158	--		
Products: Tile, nonrefractory value	$2,026	$3,059	--	Libya $2,289; United Kingdom $770.
Diamond, gem:				
Uncut and unworked do	$34,808	$355,648	--	All to Belgium.
Cut, not set value, thousands	$2,242	$3,047	--	Do.
Mica, crude, including splittings and waste value	--	$742	--	All to Italy.
Stone, sand and gravel:				
Stone, dimension:				
Unworked, calcareous do	$548	$1,222	--	Egypt $1,220; Italy $2.
Worked do	$5,680	$13,662	--	United Kingdom $9,024; Libya $2,699; Italy $1,934.
Sulfur:				
Elemental, excluding precipitated and colloidal	37	--		
Other	200	--		
Other:				
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s value	--	$1,396	--	All to Libya.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black do	$20,821	--		
Petroleum:				
Partly refined 42-gallon barrels	25,774	32,512	--	All to Italy.
Refinery products:				
Lubricating oils and grease do	29,291	5,428	--	Mainly to bunkers.
Unspecified value, thousands	$11,921	$16,095	NA	NA.

NA Not available.

Table 3.—Malta: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide ---------- value	$2,005	$2,255	--	France $1,197; Yugoslavia $980; West Germany $78.
Metal including alloys: Semimanufactures value, thousands	$2,167	$3,383	$3	Italy $1,932; United Kingdom $656; West Germany $235.
Arsenic trioxide, pentoxide, acid ---- value	NA	$1,809	--	All from Ireland.
Chromium oxide and hydroxide ---- do	$4,525	$3,592	--	United Kingdom $1,993; France $1,599.
Copper:				
Matte ---------- kilograms	--	980	--	All from West Germany.
Metal including alloys:				
Blister and other unrefined ---- do	--	5,902	--	Sweden 5,867; West Germany 35.
Scrap ----------	110	90	--	All from Libya.
Unwrought ----------	4	12	--	Sweden 8; United Kingdom 2; France 2.
Semimanufactures value, thousands	$996	$1,746	$1	West Germany $729; United Kingdom $492; France $217.
Gold metal including alloys:				
Bullion, unwrought ---------- troy ounces	28,160	20,662	--	United Kingdom 16,994; West Germany 3,636; Netherlands 32.
Waste and sweepings ---------- do	--	15	--	All from United Kingdom.
Leaf and other partly worked ---- value	$17,364	$23,758	--	West Germany $15,982; United Kingdom $7,776.
Iron and steel metal:				
Scrap ----------	59	5	--	United Kingdom 4.
Pig iron and cast iron ----------	461	190	--	Czechoslovakia 160; West Germany 26; United Kingdom 3.
Spiegeleisen ----------	12	9	--	All from Italy.
Sponge iron, powder, shot ----------	817	1,495	--	Greece 1,303; United Kingdom 182; Italy 10.
Steel, primary forms ----------	17	34	(1)	United Kingdom 23; West Germany 8; Austria 3.
Semimanufactures:				
Bars, rods, angles, shapes, sections value, thousands	$4,203	$6,029	--	United Kingdom $2,059; Belgium $1,053; Luxembourg $983; France $906.
Universals, plates, sheets ---- do	$4,692	$5,935	--	Japan $2,006; Italy $1,257; France $928; Belgium $729.
Hoop and strip ---------- do	$162	$254	--	United Kingdom $130; West Germany $43.
Rails and accessories ---------- do	$15	$1	--	All from United Kingdom.
Wire ---------- do	$1,851	$1,422	(1)	United Kingdom $396; France $393; Romania $202.
Tubes, pipes, fittings ---------- do	$3,352	$4,639	$4	United Kingdom $1,741; Italy $1,359; Netherlands $499.
Castings and forgings, rough do	$7	--		
Lead:				
Oxide ---------- value	$130,249	$151,920	--	United Kingdom $117,530; France $34,389.
Metal including alloys:				
Scrap ----------	1	180	--	All from Libya.
Semimanufactures ---------- value	$64,228	$71,528	$237	United Kingdom $45,411; Netherlands $14,204; Taiwan $1,697.
Magnesium metal including alloys, all forms kilograms	507	150	--	All from West Germany.
Manganese oxide ---------- value	--	$1,144	--	West Germany $603; United Kingdom $541.
Mercury ---------- do	$569	$145	--	United Kingdom $131; West Germany $14.
Nickel metal including alloys, semimanufactures ---------- value, thousands	$3,271	$6,003	--	West Germany $4,561; Switzerland $1,398; United Kingdom $41.
Platinum-group metals including alloys, all forms ---------- troy ounces	1,739	69	--	Switzerland 51; United Kingdom 12; West Germany 6.
Silver metal including alloys, all forms do	101,403	90,530	--	West Germany 45,409; United Kingdom 44,525; Italy 331.
Tantalum metal including alloys, all forms value	--	$2,336	--	All from United Kingdom.
Tin metal including alloys, all forms do	$278,171	$158,727	--	United Kingdom $81,564; France $49,157; West Germany $8,558.
Titanium oxide ---------- do	$200,969	$279,646	--	United Kingdom $118,957; Italy $114,125; West Germany $39,435.
Tungsten metal including alloys, all forms do	--	$2,224	--	All from United Kingdom.
Uranium and thorium metals including alloys, all forms ---------- do	$1,532	$9,612	--	Do.

See footnotes at end of table.

Table 3.—Malta: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc:				
Oxide ——— value	$47,842	$50,748	--	Netherlands $28,235; United Kingdom $12,878; Sweden $9,417.
Metal including alloys:				
Scrap ———	17	24	--	All from France.
Blue powder ——— kilograms	--	1	--	All from Italy.
Unwrought ———	48	90	--	Belgium 40; Republic of Korea 25; Norway 10; France 10.
Semimanufactures ——— value	$114,275	$186,124	--	United Kingdom $67,522; Belgium $53,349; Yugoslavia $20,640.
Other:				
Oxides, n.e.s ——— do	$40,995	$38,191	--	United Kingdom $26,778; West Germany $11,413.
Metals including alloys, all forms:				
Metalloids ——— do	$3,291	$1,195	--	Italy $1,033; United Kingdom $162.
Alkali, alkaline-earth, rare-earth metals ——— do	$4,914	$168	--	All from United Kingdom.
Base metals including alloys, all forms, n.e.s ——— do	$340	$5,164	--	Do.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, natural corundum, etc. do	$26,351	$36,681	--	Italy $18,427; Yugoslavia $12,903; West Germany $2,490.
Dust and powder of natural and synthetic precious and semiprecious stones do	$29,317	$41,610	--	Belgium $23,197; United Kingdom $13,448; Ghana $3,475.
Grinding and polishing wheels and stones do	$410,919	$380,159	$4,131	Italy $89,332; United Kingdom $88,076; West Germany $75,681.
Artificial corundum ——— do	$1,925	$4,898	--	All from Yugoslavia.
Asbestos ——— do	$10,478	$6,763	--	Italy $5,660; United Kingdom $1,102.
Boron:				
Borate and perborate ——— do	$31	$1,024	--	All from United Kingdom.
Oxide and acid ——— do	$216	$798	--	Do.
Cement ———	120,251	123,920	NA	NA.
Chalk ——— value	$38,353	$44,465	--	United Kingdom $24,763; France $14,969; West Germany $1,993.
Clays and clay products:				
Crude:				
Plastic ———	274	254	--	Italy 228; United Kingdom 26.
Fire clay ———	6	15	--	All from United Kingdom.
Other, not expanded or activated	1,821	217	--	United Kingdom 167; Italy 45; West Germany 4.
Products:				
Refractory (including nonclay brick) value	$283,483	$77,923	$4,982	United Kingdom $41,347; China, mainland $17,405; France $13,551.
Nonrefractory value, thousands	$1,808	$2,640	--	Italy $2,429; United Kingdom $172; West Germany $24.
Cryolite and chiolite ——— value	--	$1,488	--	All from Yugoslavia.
Diamond:				
Gem:				
Uncut and unworked value, thousands	$2,967	$6,717	--	Netherlands $1,764; Belgium $1,659; Republic of South Africa $1,400.
Cut, not set ——— value	$42,514	$8,527	--	United Kingdom $6,886; West Germany $815; Switzerland $673.
Industrial ——— do	--	$97,423	--	All from United Kingdom.
Diatomite and other infusorial earth do	$36,127	$17,584	--	Italy $9,892; United Kingdom $2,939; Spain $2,607.
Fertilizer materials:				
Manufactured:				
Nitrogenous ———	2,504	2,136	--	Italy 1,750; West Germany 330; United Kingdom 52.
Phosphatic ———	17	10	--	Mainly from Belgium.
Potassic ———	78	13	--	United Kingdom 10; Belgium 3.
Other including mixed ———	382	22	--	United Kingdom 19; West Germany 2.
Ammonia ——— value	$27,122	$36,976	--	United Kingdom $22,943; France $12,766.

See footnotes at end of table.

Table 3.—Malta: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Graphite:				
Natural ____ kilograms	--	34	--	All from United Kingdom.
Artificial ____ value	$416	$170	--	United Kingdom $167; Belgium $3.
Colloidal ____ do	$478	$399	--	All from Italy.
Gypsum and plasters ____ do	$27,597	$43,117	$1,929	Spain $15,613; United Kingdom $12,365; Italy $8,948.
Magnesite ____ do	$4,709	$1,451	--	United Kingdom $1,412; Italy $34.
Mica, crude, including splittings and waste ____ do	$1,748	$9,141	--	Madagascar $4,915; Italy $1,959; India $1,270.
Pigments, mineral:				
Natural ____ do	$138	$1,443	--	All from United Kingdom.
Iron oxides, processed ____ do	$16,566	$8,993	--	United Kingdom $8,608; Spain $385.
Precious and semiprecious stones except diamond:				
Natural, worked and unworked ____ do	$32,200	$324,228	$165	Netherlands $257,811; Belgium $41,040; Switzerland $18,466.
Synthetic or reconstructed, worked and unworked ____ do	$3,517	$42,614	--	Belgium $40,144; United Kingdom $1,683; Taiwan $550.
Salt and brine[2] ____ do	$163,192	$213,444	$346	United Kingdom $189,817; West Germany $14,648.
Sodium and potassium compounds, n.e.s.:				
Caustic soda ____ do	$89,727	$254,155	--	West Germany $119,794; Spain $69,937; United Kingdom $31,043.
Caustic potash ____ do	$31	$92	--	All from Czechoslovakia.
Soda ash ____	20	81	--	West Germany 65; Netherlands 10; United Kingdom 5.
Other ____ value	$1,558	--		
Stone, sand and gravel:				
Stone, dimension:				
Unworked ____ value, thousands	$768	$1,015	--	Italy $1,004; Portugal $6.
Worked ____ value	$69,228	$185,603	--	Italy $174,505; Spain $10,871.
Gravel and crushed rock ____ do	$469,205	$575,924	--	Italy $549,434; Greece $16,747; United Kingdom $5,116.
Quartz and quartzite ____ do	$10,431	$374	--	All from Italy.
Sand, excluding metal bearing ____	932	349	--	Belgium 290; Italy 35; United Kingdom 20.
Sulfur:				
Elemental:				
Colloidal ____	--	15	15	
Sublimated or precipitated ____	38	78	--	Italy 75; United Kingdom 3.
Other ____	1	2	--	All from United Kingdom.
Sulfur dioxide ____ value	$29,135	$6	--	All from Italy.
Sulfuric acid ____ do	$119,864	$53,829	--	Netherlands $46,486; West Germany $6,436.
Talc and steatite ____ do	$25,239	$24,405	--	Norway $7,357; Australia $5,055; Denmark $4,231.
Other:				
Crude: Amber, meerschaum, etc ____ do	$35,166	$3,243	--	Austria $2,470; West Germany $773.
Halogens ____ do	$6,330	$98,660	--	United Kingdom $59,576; West Germany $39,084.
Oxides, hydroxides, peroxides of magnesium, strontium, barium ____ do	$6,335	$15,616	$179	United Kingdom $9,308; Japan $3,751; Netherlands $2,300.
Mineral products, activated ____ do	$10,262	$8,170	--	United Kingdom $7,226; West Germany $943.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s. ____ value, thousands	$669	$1,249	--	Italy $938; France $133; United Kingdom $75.
Others, n.e.s ____ value	$473	$89,846	--	Yugoslavia $89,315; Netherlands $530.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural ____	4	2	--	All from United Kingdom.
Carbon black ____ value	$311,641	$348,162	$15,608	Italy $153,477; West Germany $128,086; United Kingdom $36,348.
Coal including briquets:				
Anthracite and bituminous ____	349	--		
Briquets ____	389	336	--	Poland 303; United Kingdom 33.
Coke and semicoke ____	--	88	--	Mainly from Poland.
Hydrogen and rare gases ____ value	$8,769	$9,241	--	Italy $8,786; West Germany $315.
Peat including briquets ____	303	177	--	United Kingdom 94; Netherlands 57; Sweden 25.

See footnotes at end of table.

Table 3.—Malta: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products:				
Lubricating oils[3] ___42-gallon barrels__	23,154	27,198	40	Netherlands 11,996; Belgium 4,658; United Kingdom 4,536.
Nonlubricating oils_____value__	$85,223	$69,699	__	United Kingdom $67,285; Italy $1,393.
Mineral jelly_____do____	$8,657	$11,388	__	United Kingdom $11,181; West Germany $207.
Mineral wax_____42-gallon barrels__	2,280	3,463	__	Hungary 1,228; West Germany 814; United Kingdom 663.
Bitumen _____do____	4,037	4,791	__	Italy 4,684; United Kingdom 107.
Bituminous mixtures value, thousands__	$64	$1,747	__	Italy $1,481; United Kingdom $257; France $8.
Pitch coke and tar __42-gallon barrels__	1,422	2,998	__	All from United Kingdom.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ____value__	$215,566	$36,103	$2,992	United Kingdom $22,588; France $10,522.

NA Not available.
[1]Less than 1/2 unit.
[2]Of the 1978 total, a quantity of 1,322 tons was valued at $110,696; of the 1979 total, a quantity of 724 tons was valued at $90,817.
[3]Excludes quantities valued at $332,828 in 1978 and $354,964 in 1979.

The Mineral Industry of Mauritania

By Peter J. Clarke[1]

Continued weakness of the world market for iron ore caused the virtual stagnation of Mauritania's economy in 1980. For the past 20 years, the mining sector has been central to the development of the economy, and the recent supply disruptions from guerrilla operations in Western Sahara and the lagging world demand for iron ore has caused considerable economic and political problems for the country. Withdrawal from the Western Sahara conflict and rapprochement with Algeria precipitated a small economic recovery in 1979, but the mineral sector's percentage of total gross domestic product (GDP) continued to decline from 21% in 1979 to 17% in 1980.

The country's economy is highly dualistic, with about 25% of the $546 million[2] GDP originating in the traditional sector, principally from fishing, livestock, and cereal cultivation. The modern sector, which includes mining, transportation, and a small manufacturing sector, contributed another 20% to the total GDP, with Government and other services representing the remainder.

Mauritania's balance of payments has also deteriorated, mainly because of the closing of the Akjoujt copper mine in 1978, a decrease in iron ore exports, and a correspondingly large increase in imports. The Government of Mohamed Khouna Ould Heydalla attempted to bring Government spending and the external trade balance under control late in 1978, but succeeded only in holding the situation stable. Improvement in the balance of payments remained tied to the level of iron ore exports, which account for 60% to 70% of the country's total foreign exchange receipts.

The organization responsible for the country's mining activity was the Société Nationale Industrielle et Minière (SNIM). It was a Government-owned holding company until 1979, when it sold 49% of its stock to obtain financing for the country's main development project, the Guelbs iron ore project. The company planned to start exploitation of low-grade iron ore reserves, near the existing mines, by 1983. The new shareholders in SNIM were the Arab Mining Co., the Islamic Development Bank, and the Governments of Morocco, Kuwait, Iraq, and Libya.

Another major infrastructure and development project in the country was the deepwater port at Nouakchott, under construction supervised by a group from mainland China. The port was scheduled for completion by 1984, which would coincide with increased shipments of iron ore from the Guelbs project. Development in the agricultural sector was centered around the $80 million Gorgol irrigation project on the Senegal River. The project, which was to lead to a large-scale expansion of cereal and rice production, was being financed by a consortium of international donors. Also under construction was the Nouakchott to Nema road, linking the Mauritanian coast to the eastern borders of the country. Saudi Arabia was a major aid donor for this project.

PRODUCTION

Production of Mauritania's major mineral commodity—iron ore—declined slightly in 1980, mostly because of poor market conditions. Iron ore output was down 8% from 1979, but still well above the low of 7 million tons in 1978, when the conflict with Western Sahara was at its peak. Market conditions precipitated the decline in production as well as an overall decline in export value for the year. Crude steel production, from a new scrap mill in Nouadhibou, increased considerably from 6,200 in 1979 to over 9,000 tons of reinforcing bars in 1980. Since the closing of the Akjoujt copper mine in 1978, the only other minerals being exploited were gypsum and salt. Gypsum production increased about 6% in 1980 and salt production remained stable.

Table 1.—Mauritania: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979	1980[p]
Copper, mine output, metal content, metric tons	9,431	7,640	1,773	--	--
Gold, troy ounces	22,120	28,000	8,000	--	--
Gypsum, metric tons	11,195	10,176	13,438	16,051	[e]17,000
Iron and steel:					
Iron ore:					
Gross weight, thousand metric tons	9,644	9,794	6,934	9,373	8,600
Iron content[e], do	6,233	6,317	4,299	5,811	5,332
Crude steel, metric tons	--	--	--	6,200	9,000
Rare-earth metals: Monazite concentrate, gross weight[e], do	100	100	100	100	--
Salt, marine[e], do	1,000	1,000	1,000	1,000	1,000
Silver, troy ounces	31,572	[e]26,000	19,000	--	--

[e]Estimated. [p]Preliminary.
[1]Table includes data available through Sept. 3, 1981.
[2]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone and sand and gravel) presumably are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

TRADE

Mauritania's balance of payments situation did not improve in 1980, despite the austerity program instituted by the old Government, and upheld by the military Government. The 1979 balance of trade showed a $146 million deficit, and the current accounts deficit rose to $230 million. The increased level of foreign aid from international organizations, Saudi Arabia, France, and others reached $127 million, which caused a significant reduction in the overall balance of payments deficit, to about $7 million.

Iron ore exports in 1980 remained at nearly the same level as the previous year—about 9 million tons—but the weakness of the world market for iron ore caused a slight decline in export revenues, which represent over one-half of the country's total export revenues. Iron ore was exported to France, 35%; Italy, 22%; Japan and other Western European countries, the remaining 43%. The country's other major exports were livestock, fish, cereals, and gypsum. Gypsum production was exported entirely to Senegal. Mauritania's major imports were fertilizer, cement, petroleum products, and manufactured goods.

Table 2.—Mauritania: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	Destinations, 1976	
		United States	Other (principal)
METALS			
Copper:			
Ore and concentrate	11,426	NA	NA.
Metal including alloys, waste and scrap	6	--	All to France.
Iron and steel:			
Ore and concentrate, excluding roasted pyrite, thousand tons	9,664	NA	NA.
Roasted pyrite, do.	1,967	--	France 641; Japan 534; Italy 196; United Kingdom 196.
Metal, semimanufactures	6,165	(1)	Italy 4,216; Spain 1,654; Senegal 238.
Nickel metal including alloys, waste and scrap	3	--	All to France.
Tin metal including alloys, waste and scrap, kilograms	590	--	Do.
NONMETALS			
Gypsum and plaster	7,901	--	Senegal 7,900; Italy 1.
Sand, excluding metal-bearing, kilograms	198	--	All to France.
Other, crude, do.	608	--	Italy 590; France 18.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor and aviation, 42-gallon barrels	2,781	--	Mainly for bunker.
Jet fuel, do.	22,828	--	Bunker 18,545; United Kingdom 1,957; Gabon 1,458.
Kerosine, do.	6,303	--	Bunker 3,653; Gabon 2,562; Morocco 88.
Distillate fuel oil, do.	55,678	--	Bunker 20,491; Senegal 9,418; Algeria 7,314.
Lubricants, do.	104	--	Bunker 94; France 10.

NA Not available.
[1]Less than 1/2 unit.

Table 3.—Mauritania: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	Sources, 1976	
		United States	Other (principal)
METALS			
Aluminum metal including alloys, semimanufactures	39	(1)	France 15; Austria 10; Ivory Coast 5.
Copper metal including alloys, semimanufactures	18	2	France 14; Spain 1.
Iron and steel metal:			
Scrap	1	--	All from Senegal.
Pig iron, ferroalloys, similar material	3	--	All from France.
Semimanufactures	17,666	713	France 10,138; Belgium-Luxembourg 1,578.
Gold metal including alloys, unwrought and partly wrought, troy ounces	32	--	All from France.
Lead:			
Oxides	3	--	France 2; Spain 1.
Metal including alloys, semimanufactures	5	--	France 3; China, mainland 1.
Manganese oxides, kilograms	150	--	All from France.
Nickel metal including alloys, semimanufactures, do.	273	45	United Kingdom 140; France 88.
Phosphorus, elemental, do.	600	--	All from West Germany.
Silver metal including alloys, unwrought and partly wrought, troy ounces	21,702	--	France 12,860; Switzerland 4,662; Austria 3,215.
Tin metal including alloys, semimanufactures	6	--	All from France.
Titanium oxides	6	--	Do.
Zinc:			
Oxide, kilograms	204	--	France 200; West Germany 4.
Metal including alloys, semimanufactures	37	--	France 32; Poland 5.

See footnotes at end of table.

Table 3.—Mauritania: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	Sources, 1976	
		United States	Other (principal)
METALS —Continued			
Other:			
Oxides	1	--	All from France.
Metals:			
Pyrophoric alloys, ferrocerium kilograms	96	--	Do.
Alkali, alkaline earth, rare-earth metals do	119	--	West Germany 104; France 15.
Metalloids	5	--	All from Senegal.
Base metals including alloys, semi-manufactures	3	--	Mainly from France.
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	6	(1)	France 4; West Germany 1.
Grinding and polishing wheels and stones	33	6	France 12; West Germany 11; Austria 3.
Asbestos, crude	3	NA	NA.
Barite and witherite	10	--	All from France.
Boron materials: Acid and oxide kilograms	67	--	All from West Germany.
Cement	58,821	--	Senegal 31,520; Spain 23,806; China, mainland 1,874.
Chalk	19	--	All from France.
Clays and clay products:			
Crude clays:			
Bentonite	165	--	Senegal 115; France 50.
Other kilograms	680	680	
Clay products:			
Refractory including nonclay brick	301	--	East Germany 245; Austria 42; France 9.
Nonrefractory	656	8	France 368; Spain 193.
Diamond, all grades thousand carats	450	--	France 325; Austria 125.
Diatomite and other infusorial earth	3	--	All from Austria.
Fertilizer materials: Ammonia	17	--	Spain 14; France 3.
Graphite, natural kilograms	1	--	All from Switzerland.
Gypsum and plaster	18	--	Senegal 11; France 5; Morocco 1.
Lime	201	--	France 120; Senegal 81.
Pigments, mineral: Processed iron oxide	3	--	All from France.
Salt	1,815	--	Senegal 1,797; France 13.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	10	--	France 9; Spain 1.
Caustic potash	100	--	Mainly from West Germany.
Soda ash kilograms	500	--	All from France.
Stone, sand and gravel:			
Dimension stone, worked	233	--	Senegal 212; China, mainland 21.
Dolomite, chiefly refractory grade	15	--	All from France.
Gravel and crushed rock	243	--	All from Senegal.
Sand, excluding metal-bearing	54	--	All from France.
Sulfur:			
Elemental kilograms	750	--	Do.
Sulfuric acid, oleum	48	(1)	France 33; Netherlands 8; West Germany 5.
Talc, steatite, soapstone	5	--	All from France.
Other:			
Crude kilograms	172	--	Do.
Halogens	24	--	Mainly from West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades	5,239	--	All from France.
Hydrogen, helium, rare gases kilograms	5,519	3,280	France 2,239.
Petroleum and refinery products:			
Crude 42-gallon barrels	1,366	--	Venezuela 728; Iran 638.
Refinery products:			
Gasoline do	102,956	--	Senegal 76,824; United Kingdom 9,143.
White spirit do	1,134	67	France 27.
Kerosine do	10,018	--	Senegal 9,274; Gabon 742.
Jet fuel do	40,718	NA	Netherlands 15,563; United Kingdom 11,001; Senegal 6,180.
Fuel oils do	559,842	3,863	Netherlands 269,381; United Kingdom 74,671; Belgium-Luxembourg 59,776.
Lubricants do	24,329	262	France 7,620; Senegal 1,019; Brazil 161.
Other:			
Liquefied petroleum gas do	7,049	NA	France 1,984; Ivory Coast 1,955.
Mineral jelly and wax do	63	--	Mainly from West Germany.
Unspecified do	47,098	NA	Brazil 40,316; Venezuela 3,424.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	45	--	West Germany 43; France 2.

NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Copper.—Several feasibility studies concerning reopening the Akjoujt copper mine have been conducted since 1979 by various consultants. The mine, which began production in 1970, closed in 1978 because of heavy financial losses. The mine was originally designed to extract copper oxide ores (average grade 2.7% copper), but the treatment process used to concentrate the ore encountered technical problems, and only a limited amount of concentrate was ever produced. By 1978, the oxide ores were nearly exhausted. Financial losses, caused by low production levels, and the use of a highly energy-intensive treatment process caused the mine to close.

Since 1978, the Government has attempted to attract investors to exploit the estimated 17 million tons of copper sulfide ore (average grade 2.25% copper) remaining at Akjoujt. In October 1980, a new company, Société Minière d'Inchiri, was formed to reactivate the mine, provided the feasibility studies were positive. The Mauritanian Government held a majority share in the company, along with the Iraqi Government (25%), and the Arab Mining Co. (20%). The Kuwaiti Foreign Investments Co. and the Arab Investment Co. of Saudi Arabia also planned to participate.

Iron Ore.—Iron ore output declined slightly in 1980, mostly due to the weakness of the world market for iron ore. Mining was carried out under the direction of Complexe Minière du Nord (Cominor), which was owned entirely by SNIM. Cominor operated three mines—Tazadit, F'Derik, and Rouessa—all in the Kedia d'Idjill deposit, near the city of Zouirat. The average ore grade from the mines was around 65% iron. Production from these deposits began in 1960, under the direction of the Société Anonyme des Mines de Fer de Mauritanie, in which the Government held a 5% interest. The mines were nationalized in 1974, and iron ore output peaked at 11.9 million tons that year. Output has declined in recent years owing to both poor market conditions and guerrilla warfare operations near the mines and transportation routes.

At the country's current rate of production, reserves at Kedia d'Idjill were expected to be depleted in the early 1990's. To ensure continued production of the country's major export, SNIM was beginning a major iron ore project to exploit the El-Rhein and Oum Arwagen deposits. The so-called Guelbs project was the country's top development priority, and work on the first stage of the project began in 1980.

The word Guelbs, which means "rocky outcrop or hills," was actually applied to a group of about 25 deposits, all within a 50-kilometer radius of Zouirat. The first stage of the project was to develop the El-Rhein deposit, which contained over 260 million tons of ore, grading 37% to 40% iron. The deposit was to produce around 3 million tons per year at the start, sometime in 1983, and then rise to 6 million tons per year by 1987. Included in the plan was the construction of a concentrating plant to raise the iron content to 65% iron. Concentration was to be dry magnetic separation, which is very important for a country with limited quantities of water. Total investment in the first stage of the project was estimated at nearly $500 million. At the end of 1980, about $22 million had been spent on development.

The second phase of the Guelbs project was centered around the Oum Arwagen deposit, where reserves were estimated at an additional 200 million tons, with an iron content of about 38%. Annual production capacity from Oum Arwagen was to be 4 million tons in 1990, rising to 6 million tons by 1992. This phase of the project, along with commissioning the second part of the concentration plant, was to take place in 1990. Concentrates from both deposits were to be transported by the 650-kilometer railroad that already links the Kedia d'Idjill deposit to Nouadhibou.

A pilot plant for research in iron ore concentrating and separating techniques began operating in Zouirat in 1974. The pilot plant produced a concentrate containing 64% to 66% iron as magnetic and oxidized sinter feed, utilizing autogenous grinding and dry magnetic separation techniques. This process was to be used at the new beneficiation plant in Zouirat for both the El-Rhein and Oum Arwagen ores.

A small steelworks began operating at the port of the rail line from Kedia d'Idjill to Nouadhibou in 1979. Design capacity at the plant was 12,000 tons per year of raw steel. Total production from the plant in 1980 was around 9,000 tons, about 66% of which was exported to neighboring countries.

NONMETALS

Gypsum.—Since the closing of the Akjoujt copper mine, the only other mining operation under SNIM's authority has been the extraction of gypsum from a deposit at Sebka N'Drhamcha, located about 65 kilometers north of Nouakchott. The entire quantity of gypsum produced was exported to Senegal for use in the Société Ouest-Africaine des Ciments plant at Rufisque. SNIM planned to expand its output of gypsum when the new deepwater port at Nouakchott is completed. Mauritania had no cement plants operating in 1980, although SNIM was reportedly considering construction of a 150,000-ton-per-year plant which would utilize locally derived raw materials.

Phosphate.—Phosphate deposits near the southern border of the country, in the Aleg-Boghe-Khaedi area, were being studied to determine their economic potential. Reserves at the deposit were estimated at between 20 and 40 million tons of ore. The mining rate being considered was around 500,000 tons per year, but infrastructure remained a critical problem.

Salt.—A small amount of rock salt was produced in Mauritania, mostly by small operators. Annual production averaged 1,000 tons which was sufficient for domestic consumption. Feasibility studies were conducted by the Compagnie pour Etudes Techniques et Economiques of France for exploitation of salt deposits at Sebkha N'Drhamcha. Reserves at the deposit were estimated at 11 million tons of salt. No decision was made to exploit the deposit.

MINERAL FUELS

Petroleum.—All petroleum exploration efforts conducted thus far in Mauritania have proven unsuccessful. Initial efforts in the 1960's and 1970's were carried out in the Atlantic Basin area, near Nouakchott and in the Tindouf Basin, near the Algerian border. The El Djouf Basin in the west-central part of the country near the Mali border has also been explored without success. Recent exploration has concentrated on the onshore and offshore Nouadhibou region. A consortium including Hispanoil (Spanish State Oil Co.), Philips Petroleum Co. (United States), Shell Oil Co. (United States), and Azienda Generale Italiana Petroli (Italy), held a 24,000-square-kilometer concession both onshore and offshore Nouadhibou. Elf Aquitane (France) also began exploring a concession offshore Nouakchott in 1980, but with no significant results.

Refining.—The Nouadhibou refinery, which had been closed since its first test run in 1978, remained idle in 1980. The refinery, built by Vöest Alpine (Austria), was closed following crude oil supply problems and the need for technical modifications, but because of financial constraints it was never able to reopen. Output of the refinery was to be 1 million tons of refined products per year, which would satisfy domestic requirements and provide a substantial surplus for export. There was no indication in 1980 that the refinery would commence operating soon.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Mauritanian ouguiyas (UM) to U.S. doliars at the rate UM46.00=US$1.00.

The Mineral Industry of Mexico

By Orlando Martino[1]

Mexico is one of the leading producers of mineral commodities in the world. The development of new oil reserves and the surge in oil and natural gas production since 1976 have overshadowed the traditional roles played by the metallic and nonmetallic mineral industries. By the end of 1980, Mexico became the fifth most important oil producer in the world and was a rival to Venezuela as the leading oil producer and exporter in Latin America. In 1981, Mexico is expected to overtake Venezuela and gain fourth rank as a world oil producer after the U.S.S.R., the United States, and Saudi Arabia.

Mexico's rapid economic growth continued in 1980. The gross domestic product (GDP) increased in real terms by 7.4% compared with the 8% growth in 1979. The economic performance in 1980 registers the third straight year of growth exceeding 7%. Growth was stimulated by significant increases in Government and private investments that counteracted the negative impact of serious bottlenecks in the transportation system and shortages of skilled labor and certain raw materials. At current prices, the GDP was valued in 1980 at $167 billion.[2] The inflation rate was 30% compared with the 20% rate in 1979.

The record high output of petroleum (not including petrochemicals) in 1980 represented 4.5% of the GDP, or a value of $7.5 billion, while output of metallic and nonmetallic minerals represented 1.1% of the GDP, or about $1.8 billion. The latter value does not include certain processed commodities such as steel and cement. The mineral industry (including hydrocarbons) accounted for 69% of Mexico's total exports.

The petroleum sector's contribution to Mexico's GDP increased almost 18% in 1980, the second highest annual growth rate registered by this sector since 1950. The relative importance of the mining sector has decreased from 1.5% of the GDP in 1970 to 1.1% of the GDP in 1980. During the decade prior to 1979, mining output increased at an average of 2.5% per year. The value of mining output in real terms is estimated to have increased 6.6% overall in 1980 compared with the 4% growth in 1979 and is expected to continue in an expansive phase in response to a growing economy's need for more raw materials. The increase in foreign exchange earnings generated by petroleum exports has made it possible to increase imports of capital equipment needed for expanded investments in the nonfuel minerals sector. In 1980, investment in exploration, new projects, expansions, and modernization programs at existing operations rose to about $540 million compared with the $433 million expended in 1979. The Cámara Minera de México estimates that $853 million will be invested in 1981.

Regarding nonfuel minerals, Mexico is the world's leading producer of silver, fluorspar, and strontium minerals (celestite). It ranks second in arsenic and natural graphite; third in antimony and bismuth; and is a significant world producer of cadmium, lead, mercury, zinc, selenium, sulfur, feldspar, and natural sodium sulfate. Continued development toward full capacity of the La Caridad copper project and the opening of other mining sites at Cananea will significantly improve Mexico's position as a copper producer. The San Juan de la Costa and Santo Domingo phosphate projects in Baja California State are expected to reduce Mexico's dependency on foreign sources of fertilizer materials.

Within Latin America, Mexico shares

leadership with Peru as a lead producer; is the second most important producer of steel, zinc, cement, and petroleum; and is a significant producer of aluminum, gold, iron ore, manganese ore, coal, and ferroalloys.

Petróleos Mexicanos (PEMEX), the state monopoly responsible for oil and gas operations since 1938, achieved outstanding results in 1980 with a 33% increase in production of crude petroleum and a sizable increase in proven reserves. In January, PEMEX initiated natural gas shipments to the United States after a period of difficult negotiations. PEMEX's exploration efforts during 1980 continued to focus on discovering new reserves of hydrocarbons and to evaluate the oil potential of other areas in Mexico not currently productive. Potential oil reserves were estimated by PEMEX at 250 billion barrels, including proven reserves.[3]

Two decentralized Government agencies operating in the mineral sector are the Consejo de Recursos Minerales (CRM), founded in 1955, and the Comisión de Fomento Minero (Fomento Minero), founded in 1976. CRM actively engages in mineral exploration, supports the exploration efforts of others by conducting specific geologic studies, and annually publishes Mexico's mineral production and trade statistics. CRM has participated in a number of important mineral discoveries such as the La Caridad copper deposit, Las Truchas and Peña Colorado iron ore deposits, and the phosphate deposits of Baja California. High-priority minerals targeted in CRM's current exploration program include bauxite, iron ore, nickel, and coal. In 1980, CRM had a technical staff of 750 workers and a budget of $53 million, 70% of which was related to exploration.

Fomento Minero holds the Government interest in large mineral operations (especially where private capital is lacking); it promotes and finances small- and medium-sized mining companies and provides them with technical assistance. Fomento Minero is the 100% owner of the phosphate rock mining projects in Baja California, Macocozac copper project, Minera Santa Rosalía, Cía. Real del Monte y Pachuca, and Zincamex S.A. Fomento Minero is a majority owner in Azufrera Panamericana S.A. (APSA) (sulfur), Cía. Exploradora del Istmo (sulfur), and Exportadora del Sal (salt). As a minority partner, Fomento Minero has an interest in a number of large and small mineral operations, including Cananea copper (13%), La Caridad copper (6%), Real de Angeles silver (33%), and Micare coal (40%).

In the area of new developments and expansion programs, 1980 was the scheduled completion date of various projects. These included Cuale, Jalisco (nonferrous metals); Cumobabi, Sonora (molybdenum); Velardeña, Durango (nonferrous metals); San Juan de la Costa, Baja California (phosphate rock); and La Minita, Michoacán (barite and nonferrous metals). In 1981, completion of the following projects was expected: Cananea, Sonora (copper); Santa Bárbara, Chihuahua (nonferrous metals); Taxco, Guerrero (nonferrous metals); and La Caridad, Sonora (molybdenum plant).

Government Policies and Programs.—In April, the Government issued the long-awaited master development plan for Mexico—Plan Global de Desarollo (PGD)—designed to provide a unified framework for sectoral development plans, some of which were issued before. The industrial development plan was issued in 1979. The national energy plan issued in November is a subplan under the PGD. The PGD outlined the goals of the López Portillo administration: To reaffirm Mexico's independence, provide adequate employment, encourage economic growth, and improve the distribution of income.

When the Alliance for Production was first announced, projected investment goals for López Portillo's 6-year term (sexenio) were $2.2 billion for the mineral industry. The $800 million invested in 1980 indicates that Mexico's mineral industry will have reached this goal before the sexenio ends in July 1982.

There were no significant changes in the mining law since publication of the 1977 law. In early 1980, there were changes in the tax system for gold and silver, finally resulting in a variable tax (0% to 40%) based on existing market prices for these precious metals. The tax on silver begins at 6% when the price reaches $17.14 per troy ounce and graduates to 40% when the price reaches $23.30 per troy ounce. The tax on gold begins when the price reaches $404 per troy ounce and graduates to 40% when the price reaches $504 per troy ounce.

Regarding taxation, the Mexican mining law provides that, in addition to the standard corporate income tax of 42%, mining operations will pay three classes of taxes: Production, concession, and exploration. The concession taxes are levied at $1.33 per

hectare for nonmetallic minerals and $2.65 per hectare for metallic minerals. Production taxes vary according to the mineral being produced. Gold, silver, and sulfur are taxed at 9%; iron, magnesium, and coal are taxed at 4%; and other minerals are taxed at 7%. The exploration tax is levied at $0.44 per hectare per year.

Article 16 of the 1977 mining tax and development law established four general classes of subsidies. These are: (a) a subsidy of 2% on the value of the minerals produced, which is deductible immediately upon payment of the production tax (this subsidy is to be used to offset the cost of prospecting, exploration, and development that is carried out during the same calendar year); (b) an additional 1% of the above subsidy is allowed if the taxpayer has a gross annual income from mineral sales of less than $1 million; (c) a subsidy of up to 75% of the general import tax on machinery, equipment, parts, and replacements (when these are not manufactured in Mexico, except passenger vehicles); and (d) other incentives which, because of special economic circumstances, are considered necessary to safeguard or foment the development of the mining industry.

Experience to date indicates that the 1977 law succeeded in simplifying mining operations and making it easier for new operations and investments to take place. Government officials in the mining sector reported in 1980 that new changes were being considered, which will further simplify mining operations and investment. A new mining law has therefore been prepared and was expected to be approved by the end of 1980.

Foreign investment in Mexico's mineral sector remained strictly controlled. Mexican law provides for three separate classes of mining companies: State-owned, mixed, and private. In the private sector, foreign ownership is limited to a maximum of 49%, and it is limited to 34% in the mixed sector. Firms with foreign participation are largely excluded from mining such minerals as sulfur, potassium, phosphates, iron, and coal. Oil and gas production and uranium mining and processing are carried out completely by state-owned firms.[4]

In 1980, the World Bank granted a $40 million credit to the Ministry of Patrimony and Industrial Development to stimulate exploration and production from small- and medium-sized mining operations.

During 1980, output in the transportation sector showed good progress. Railroad services increased 11%; road transport increased 10%; and maritime transport increased 21%. Despite this progress, mineral production and its growth continued to be hampered by an inadequate and antiquated railroad transportation system. The lack of rolling stock has impacted on the flow of concentrate from the mines to the smelters and refineries, as well as the subsequent flow to the manufacturing plants. In 1979, mineral cargo represented about 27% of the freight handled by railroad, comprised mostly of iron ore, coal, coke, and manganese. Certain steel plants suffered from the timely supply of coke and pellets, forcing them to import iron ore pellets. Drilling operations by PEMEX have been hindered by delays in rail deliveries of barite.

In late 1980, the World Bank approved a $150 million loan to Ferrocarriles Nacionales de México to rehabilitate and expand Mexico's largest railroad network. Ferrocarriles Nacionales has 70% of Mexico's 20,200-kilometer system (mostly single-track) and handles 80% of total rail traffic. In May 1980, a rail link was inaugurated from Siderúrgica Lázaro Cárdenas Las Truchas, S.A.'s (SICARTSA) Las Truchas steel plant to Mexico City. In remote areas, trucking is often used to haul mine output. Mexico has 207,000 kilometers of highways, of which 30% are paved.

Mexico was engaged in a large port development program involving two new ports on the gulf coast at Altamira and Laguna de Ostión, and the expansion of existing port capacities at Lázaro Cárdenas and Salina Cruz on the Pacific coast. Port development at Altamira, north of Tampico, is based in part on a need for improved handling facilities for imports of iron ore. The new port will be able to service ships of up to 100,000-deadweight-ton capacity. The greatest part of crude oil exports was from the Port of Coatzacoalcos on the gulf. Mexico has a large system of pipelines to transport crude oil, refined products, and natural gas totaling about 13,000 kilometers. According to a PEMEX program, by 1990 the national system of gas pipelines will cover three times the distance of the rail system. Mexico was restoring the cargo land bridge between Coatzacoalcos on the gulf coast and Salina Cruz on the Pacific coast. The 300-kilometer trans-Isthmus rail-highway system, based on a railroad originally built by the British around 1890, was expected to be operational in late 1981.

There are approximately 920 operating companies in Mexico involved in well over 15,000 separate mining ventures. Employment in the mining sector continues to grow, reaching approximately 165,000 persons in 1980, an increase of 3% over that of 1979. Although the number of mining operations is impressive, approximately 90% of all mining operations are conducted by only five major companies. The Government of Mexico continues to emphasize the development of medium and small mines to be assisted by the World Bank loan.

PRODUCTION

Mexico's output of minerals continued to be dominated by the mineral fuels. Production of crude oil in 1980 increased 33%, following a 21% increase in 1979. Total production of natural gas also increased—22% in 1980, compared with a 14% increase in 1979. Crude oil, gas liquids, and condensate production in 1980 averaged 2.1 million barrels per day, a 32% increase over the 1979 rate. Output of barite increased in line with the demand by PEMEX for more drilling mud.

Output of copper increased 64% to a record high. Production of silver, Mexico's most valuable metal, decreased 4% despite record high prices, reflecting the drop in output of lead and zinc, which are coproducts in many of the country's mines.

Production of iron ore increased 26%. Mexico continued to expand its capacity for making steel. Output of crude steel in 1980, however, increased slightly from lower utilization of installed capacity. Production of ferroalloys (mostly ferromanganese) reached new highs, and output of manganese ore decreased.

Among the important nonmetallic minerals, production of fluorspar increased 5% and continued above the depressed level of 1977. Output of phosphate rock rebounded from the low level of 1979. Sulfur output was up slightly.

According to data published by the Secretaría de Patrimonio y Fomento Industrial,[5] the breakdown in value of total nonfuel minerals output in 1978 (the latest year available) was 18 metals contributed 72%, and 28 nonmetallics contributed 28% of the total. The value of the precious metals—gold and silver—alone accounted for almost 30% of the total value produced. In 1978, the States of Mexico that were leading producers of the most important minerals (not including oil and gas) were Sonora (copper); Durango and Guanajuato (gold); Chihuahua, Colima, and Jalisco (iron ore); Chihuahua (lead and zinc); Hidalgo (manganese); Chihuahua and Zacatecas (silver); Coahuila and Nuevo León (barite); Coahuila (coal); San Luis Potosí and Guanajuato (fluorspar); and Veracruz (sulfur).

As for the structure of Mexico's mining industry in 1979, the large private miners accounted for 55% of output value, followed by miners with Government equity (30%) and medium and small miners (15%). In 1971, mining companies with Government equity accounted for 21% of the total.

Table 1.—Mexico: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal, primary	42,358	42,720	43,092	43,195	[e]43,200
Antimony:[3]					
Mine output, metal content	2,546	2,698	2,457	2,872	2,176
Metal (in mixed bars and refined)	593	934	490	557	422
Arsenic, white[4]	5,499	5,744	6,245	6,537	6,332
Bismuth[5]	557	729	978	754	770
Cadmium:					
Mine output, metal content	1,844	1,781	1,894	1,778	1,791
Metal, refined	710	908	897	830	778
Copper:					
Mine output, metal content	88,970	89,662	87,186	107,109	175,399
Metal:					
Blister (primary only)	85,175	87,457	86,978	83,857	85,695
Refined (primary and secondary)	75,418	73,062	74,990	81,781	85,610
Gold:					
Mine output, metal content, troy ounces	162,811	212,709	202,003	190,364	195,991
Metal, refined, do	150,722	196,634	190,718	187,439	185,863

See footnotes at end of table.

Table 1.—Mexico: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS —Continued					
Iron and steel:					
Iron ore:					
Gross weight[e] thousand tons	5,466	5,381	5,334	6,061	7,631
Metal content do	3,644	3,587	3,556	4,041	5,087
Metal:					
Pig iron and sponge iron do	3,528	4,329	5,137	5,027	5,267
Ferroalloys:					
Ferromanganese do	54	99	107	120	121
Silicomanganese do	18	27	34	35	35
Ferrosilicon do	18	23	25	25	25
Other do	3	3	5	5	5
Total do	93	152	171	185	186
Crude steel do	5,298	5,601	6,776	7,117	7,152
Semimanufactures do	4,140	4,302	5,253	5,852	5,809
Lead:					
Mine output, metal content	200,027	163,479	170,593	173,445	145,549
Metal:					
Smelter:					
Primary	189,731	153,948	166,098	172,988	144,951
Secondary (refined)[e]	45,000	62,300	49,300	50,000	50,000
Total	234,731	216,248	215,398	222,988	194,951
Refined:					
Primary (including lead content of antimonial lead)	172,665	143,742	159,342	167,149	140,294
Secondary[e]	45,000	62,300	49,300	50,000	50,000
Total	217,665	206,042	208,642	217,149	190,294
Manganese ore:					
Gross weight[7]	453,211	486,623	523,167	492,664	447,128
Metal content	163,156	175,184	188,340	177,359	160,966
Mercury, mine output, metal content 76-pound flasks	15,026	9,660	2,205	667	[e]1,500
Molybdenum, mine output, metal content	16	1	11	48	74
Nickel, mine output, metal content	56	34	22	1	--
Selenium, elemental	58	50	80	75	46
Silver:					
Mine output, metal content thousand troy ounces	42,640	47,030	50,779	49,408	47,344
Metallurgical products, metal content do	40,215	43,913	48,903	48,601	45,410
Tin:					
Mine output, metal content	481	220	73	23	60
Metal, smelter, primary[8]	800	1,000	1,000	600	400
Tungsten, mine output, metal content	188	151	234	252	262
Zinc:					
Mine output, metal content	259,183	265,469	244,892	245,477	238,231
Metal, smelter, primary	175,210	174,376	173,094	161,723	143,868
NONMETALS					
Asbestos	1	--	--	--	--
Barite	270,063	270,674	231,485	151,162	269,322
Cement, hydraulic thousand tons	12,584	13,227	14,056	15,178	[e]16,000
Clays:					
Bentonite	55,583	59,169	140,325	169,848	[e]170,000
Fuller's earth	20,108	61,369	40,615	48,820	[e]50,000
Kaolin	71,350	178,211	179,500	76,994	29,542
Common	111,362	70,313	114,000	149,000	NA
Diatomite	26,294	23,574	40,862	44,004	[e]23,000
Feldspar	73,239	114,319	109,808	110,869	[e]127,000
Fluorspar, all grades thousand tons	[r]897	[r]660	960	875	916
Graphite, all grades	60,337	58,432	52,264	50,880	44,506
Gypsum and anhydrite, crude	1,414,237	1,495,750	1,757,870	2,021,006	1,708,924
Lime thousand tons	[e]3,490	[e]4,150	[e]4,445	4,579	4,350
Magnesite	23,186	66,400	76,035	81,620	[e]80,000
Mica, all grades	1,303	771	401	243	[e]400
Nitrogen: N content of ammonia	715,729	780,321	1,303,914	1,358,800	1,547,800
Perlite	14,555	22,429	24,517	19,859	[e]25,000
Phosphate rock	224,428	285,470	322,076	171,069	283,246
Salt, all types thousand tons	4,591	4,900	5,635	6,169	6,200
Sodium compounds:					
Soda ash (sodium carbonate) do	390	[e]420	414	420	[e]450
Sodium sulfates, natural (bloedite)	228,025	109,489	330,804	362,985	365,000

See footnotes at end of table.

Table 1.—Mexico: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Stone, sand and gravel:					
Calcite, common	4,902	8,784	19,753	15,714	[e]15,000
Dolomite	347,007	433,429	249,244	282,342	[e]300,000
Limestone thousand tons	[9]4,763	[9]4,750	22,565	24,086	26,000
Marble	2,449	1,348	144,554	155,578	NA
Quartz, quartzite, glass sand (silica)	509,029	626,715	532,209	537,299	[e]550,000
Strontium minerals (celestite)	22,157	45,633	34,224	39,519	[e]45,000
Sulfur, elemental:					
Frasch process thousand tons	2,054	1,723	1,650	1,773	[e]1,800
Byproduct:					
Of metallurgy[e] do	75	[r]80	100	100	150
Of natural gas do	96	133	168	252	[e]302
Total do	2,225	1,936	1,918	2,125	[e]2,252
Talc	192	163	2,639	2,500	[e]2,700
Wollastonite	1,143	692	10,956	11,892	NA
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	171,108	109,728	207,467	270,000	[e]300,000
Coal, bituminous thousand tons	5,650	6,610	6,756	7,357	7,010
Coke:					
Metallurgical do	2,151	2,815	2,808	2,974	2,383
Imperial do	21	12	11	13	16
Breeze do	16	65	87	65	10
Total do	2,188	2,892	2,906	3,052	2,409
Gas, natural:					
Gross million cubic feet	771,774	746,863	934,911	1,064,559	1,298,581
Marketable do	577,926	600,051	744,891	914,873	1,129,288
Natural gas liquids:					
Field condensate thousand 42-gallon barrels	[e]95	105	1,259	3,597	139
Other do	34,154	38,136	42,689	53,644	70,791
Petroleum:					
Crude do	267,320	357,985	441,348	533,329	708,454
Refinery products:					
Gasoline:					
Aviation do	565	525	585	638	622
Other do	76,366	83,492	88,643	102,888	118,855
Jet fuel do	6,179	7,749	7,390	9,154	10,089
Kerosine do	13,444	12,416	13,840	14,698	15,164
Distillate fuel oil do	59,075	66,574	72,461	78,584	89,392
Residual fuel oil do	78,217	85,122	88,963	86,684	112,903
Lubricants do	3,103	2,823	2,931	2,836	2,860
Other:					
Liquefied petroleum gas do	20,278	24,030	27,024	33,058	43,829
Asphalt do	3,690	4,403	4,819	5,390	6,155
Unspecified do	[r]4,716	6,135	6,138	7,690	6,656
Refinery fuel and losses do	11,405	15,460	13,834	16,647	18,478
Total do	[r]277,038	308,729	326,628	358,267	425,003

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 24, 1981.

[2]In addition to the commodities listed, pumice and additional types of crude construction materials are produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Sb content of ores for export plus Sb content of antimonial lead and other smelter products produced.

[4]Calculated white As equivalent of metallic As content of products reported.

[5]Bi content of refined metal, bullion, and alloys produced indigenously, plus recoverable Bi content of ores and concentrates exported for processing.

[6]Calculated from reported Fe content on the basis of ore containing 66.67% iron.

[7]Calculated from reported Mn content of mine production on the basis of ore containing 36% manganese.

[8]Estimates by the International Tin Council.

[9]Excluding that for cement production.

TRADE

Mexico's international trade in mineral commodities is given in table 2 for exports and in table 3 for imports.

In 1980, Mexico's total exports increased 74% to $15.3 billion, and imports increased 55% to $18.6 billion. The value of crude oil exports increased by almost 150% in 1980 following a 114% increase in 1979. Increased foreign exchange earnings from oil exports reflect higher prices as well as increased shipments.

Since 1976, the volume of exports of petroleum has grown dramatically to become the dominant factor in Mexico's export sector. Crude oil exports in 1980 of 303 million barrels were almost seven times greater than the exports in 1976. Exports of crude oil, petroleum products, and natural gas by PEMEX in 1980 amounted to $10.3 billion. In 1980, Mexico exported 43% of its crude oil production, mostly to the United States. Mexico was approaching Venezuela as the leading producer and exporter of petroleum in Latin America. The tabulation with values shown in million dollars below shows that while oil exports have increased their share of Mexico's total exports, the mining-metallurgical share has decreased. As a comparison, in 1970, exports of mining and metallurgical products were 15% of total exports. On the other hand, Mexican imports of mining-metallurgical commodities have been at the level of 5% of total imports over the past decade. In 1980, exports of products from the extractive industries (not including oil, gold, and silver) amounted to $503 million.

	1976	1977	1978	1979	1980
Total Mexican exports	3,317	4,418	6,063	8,798	15,308
Crude oil exports	440	988	1,774	3,811	9,449
Crude oil share	13.3%	22.4%	29.3%	43.3%	61.7%
Mining, metallurgical exports	441	450	503	789	1,307
Mining, metallurgical share	13.3%	10.2%	8.3%	9.0%	8.5%

According to data recently published by the Government,[6] Mexico has had a surplus in its nonfuel minerals trade over the past decade. Between 1970 and 1978, the value of nonfuel mineral exports increased 626%. Of the metallics, silver, copper, iron ore, and manganese had the greatest growth in export value. During the same period, the nonmetallics with the greatest export growth were alabaster, asbestos, dolomite, marble, perlite, silica, salt, and sulfur. Fluorspar exports grew by 300%. The Government report provides the following breakdown in the destination of nonfuel mineral exports and the source of imports for 1978 on a percentage basis.

Region	Exports	Imports
Western Hemisphere[1]	72%	75%
Europe	21%	13%
Asia	7%	3%
Africa	(2)	8%
Oceania	(2)	1%

[1]Including Canada and the United States.
[2]Negligible amount.

In 1978, the main market for Mexican mining-metallurgical exports was the United States, with 60%, followed by Great Britain, 6%; Japan, 6%; Brazil, 5%; the Federal Republic of Germany, 5%; Belgium-Luxembourg, 4%; and Italy, 2%. In the same year, the United States supplied 62% and was the main source of mineral imports, followed by Canada, 7%; Morocco, 6%; and Great Britain, 3%.

One of the significant mineral trade events in 1980 was the initiation on January 15 of the shipment of natural gas to the United States via a new pipeline from San Fernando to McAllen, Tex., at the average rate of 281 million cubic feet per day. The gas earnings for 1980 were $448 million, based on the initial rate of $3.36 per thousand cubic feet that was later increased to $4.47 per thousand cubic feet. Beginning January 1, 1981, the rate was scheduled to increase to $4.82 per thousand cubic feet.

During 1980, Mexico and Japan negotiated an agreement to supply Japan with 300,000 barrels per day of crude oil by 1982 in exchange for technical and financial assistance for Mexico's steel industry.

Despite the remarkable growth of Mexico's steel industry, imports of steel continued to grow. Steel imports in 1979 were valued at $1.05 billion compared with $360 million expended in 1975.

In the private sector, Industrias Peñoles, S.A. de C.V. was the most important exporter of metallic and nonmetallic minerals.

Table 2.—Mexico: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	(1)	--		
Antimony:				
Ore and concentrate	r4,508	1,311	1,311	
Metal including alloys, all forms	384	534	413	Brazil 73; Japan 35.
Arsenic trioxide, gross weight	2,802	3,277	2,898	Brazil 301.
Bismuth metal including alloys, all forms	187	242	--	All to Belgium-Luxembourg.
Cadmium, refined	759	633	291	Brazil 255; France 27.
Chromium: Chromite	4	--		
Cobalt, content of concentrates	8	(1)	--	All to Guatemala.
Copper:				
Ore and concentrate, copper content	r559	18,742	--	West Germany 4,770; Republic of Korea 4,563; Spain 3,379.
Copper sulfate	1,011	458	140	Brazil 286.
Metal including alloys, all forms	960	1,682	1,369	Japan 250.
Iron and steel:				
Ore and concentrate, gross weight	r893	413	399	West Germany 14.
Metal including alloys:				
Scrap	315	1,153	1,077	France 75.
Pig iron	43	567	567	
Sponge iron, powder, shot	7,127	449	218	Colombia 101; Venezuela 82.
Ferroalloys	r34,433	39,240	NA	NA.
Steel, primary forms	1,152	17	17	
Semimanufactures	r382,485	269,591	NA	NA.
Lead:				
Ore and concentrate, lead content	11,108	2,565	2,565	
Oxides	r38,199	35,148	18,040	Venezuela 7,248; Colombia 2,070.
Metal including alloys:				
Scrap	44	--		
Unwrought	r76,864	73,590	36,207	Italy 17,122; Japan 10,221.
Semimanufactures	330	455	231	United Kingdom 105; West Germany 57.
Manganese ore and concentrate	r246,776	220,902	46,703	France 50,192; Japan 49,212; Argentina 24,601.
Mercury, 76-pound flasks	6,278	5,316	143	Brazil 4,386.
Nickel metal including alloys, all forms kilograms	2,380	1,921	--	El Salvador 1,477.
Selenium, elemental	r29	34	3	United Kingdom 22.
Silver:				
Ore and concentrate, gross weight	r29,285	15,327	15,327	
Metal, thousand troy ounces	26,472	30,477	24,330	United Kingdom 2,699; France 770.
Tin:				
Ore and concentrate	(2)	--		
Metal including alloys, all forms	1	15	--	Honduras 15.
Tungsten:				
Ore, gross weight	r192	127	127	
Concentrate, tungsten content	r534	351	351	
Zinc:				
Ore and concentrate, zinc content	r126,190	63,179	15,980	Belgium-Luxembourg 28,770; Netherlands 12,573.
Oxide	11,274	11,743	11,322	Chile 94.
Metal including alloys, all forms	r105,510	73,803	38,468	Brazil 21,762; Uruguay 2,842.
NONMETALS				
Abrasives, natural, n.e.s	r112	13	--	Brazil 12.
Asbestos	r155	42	4	Colombia 26; Venezuela 12.
Barite and witherite	r98,950	134,584	134,584	
Clays, crude:				
Bentonite	r16	74	13	Dominican Republic 50.
Fuller's earth	r14,636	12,826	552	Brazil 4,005; Peru 2,020; Chile 1,376.
Kaolin	53	4	--	Chile 1; Costa Rica 1; West Germany 1.
Other	574	505	123	Ecuador 103; Guatemala 89.

See footnotes at end of table.

Table 2.—Mexico: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond, gem, not set or strung carats	--	5,000	--	Spain 5,000.
Diatomite and other infusorial earth	r29,306	16,504	286	Brazil 8,848; Venezuela 1,822; Argentina 1,517.
Feldspar	r306	127	122	Guatemala 5.
Fertilizer materials, crude, phosphatic	1,021	--		
Fluorspar	r712,970	708,620	498,140	Canada 123,295; Netherlands 46,314; Poland 16,086.
Graphite, natural	r47,136	9,115	9,109	Insignificant.
Gypsum and plaster thousand tons	1,535	1,838	1,806	China, mainland 32.
Magnesite (including magnesium oxide)	237	260	51	Dominican Republic 150; Republic of South Africa 54.
Mica, crude, including splittings and waste	10	19	19	
Perlite, crude, ground, activated, and expanded	r5,053	2,806	61	Brazil 1,150; Cuba 628; Chile 339.
Precious and semiprecious stones except diamond kilograms	r859	444	165	Japan 110; Switzerland 61.
Salt thousand tons	r4,460	5,233	1,351	Japan 3,350; Canada 358.
Sodium compounds, n.e.s.:				
Sodium hydroxide	123	252	90	Belize 58; China, mainland 54.
Sodium sulfate	147,692	151,553	252	Brazil 110,373; Colombia 14,675; Venezuela 13,494.
Stone, sand and gravel:				
Dimension stone: Marble	r1,324	1,003	189	Colombia 593; Guatemala 112.
Dolomite, crude and calcined, chiefly refractory-grade	r532	2,461	1,360	Guatemala 801; El Salvador 261.
Gravel and crushed rock	16,733	NA	NA	NA.
Quartz and quarzite	r328	252	252	
Sand excluding metal-bearing	7,348	15,419	15,077	Guatemala 193.
Strontium minerals, celestite	37,243	39,963	39,963	
Sulfur, elemental, all forms thousand tons	r1,233	1,204	1,003	United Kingdom 80; Brazil 41.
Talc and steatite	213	(1)	(1)	
Vermiculite	r1,212	1,228	1,228	
Wollastonite	460	339	121	Nicaragua 215.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	r1,052	983	--	All to Belize.
Carbon black	970	1,079	755	Peru 184; Argentina 52.
Coal, all grades including briquets	r51	486	147	Belize 301.
Coke and semicoke	--	10	--	All to Nicaragua.
Petroleum:				
Crude thousand 42-gallon barrels	133,247	194,485	NA	NA.
Refinery products:				
Gasoline do	613	--		
Kerosine do	20	--		
Distillate fuel oil do	40	98	NA	NA.
Residual fuel oil do	--	1,442	NA	NA.
Liquefied petroleum gas do	--	2,161	NA	NA.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Revised to zero.

Table 3.—Mexico: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	r50,732	62,593	40,514	Guyana 12,321.
Oxide and hydroxide	r108,600	115,282	114,441	France 254.
Metal including alloys, all forms	r43,113	64,010	36,396	Canada 11,025; France 7,317.
Beryllium metal including alloys, all forms kilograms	10,907	4,744	4,461	Japan 3.

See footnotes at end of table.

Table 3.—Mexico: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Bismuth metal including alloys, all forms kilograms	470	15	--	Sweden 15.
Cadmium metal including alloys, all forms	r759	633	291	Brazil 255.
Chromium: Chromite	r50,919	55,016	34,002	Cuba 18,286; Philippines 2,727.
Cobalt:				
Oxide and hydroxide	129	118	55	Belgium-Luxembourg 62.
Metal including alloys, all forms	r55	59	10	Belgium-Luxembourg 39; Canada 4.
Copper metal including alloys:				
Scrap	r1,214	6,167	6,141	Insignificant.
Unwrought	r20,857	16,018	6,678	Chile 5,985; United Kingdom 2,707.
Semimanufactures	r129	114	82	West Germany 17.
Iron and steel:				
Ore and concentrate, gross weight	r148,773	571,916	341,299	Brazil 129,961; Sweden 92,843.
Metal including alloys:				
Scrap	r481,601	328,636	320,971	Japan 6,497.
Pig iron and similar materials	r46,472	44,717	43,240	Brazil 1,269.
Sponge iron, powder, shot	r8,031	22,036	21,962	Insignificant.
Ferroalloys	9,375	11,804	NA	NA.
Steel, primary forms	r46,160	126,494	89,511	West Germany 7,911; United Kingdom 5,265; Romania 5,019.
Steel, semimanufactures thousand tons	r1,219	1,417	NA	NA.
Lead metal including alloys:				
Scrap	r157	128	128	
Unwrought	129	124	124	
Semimanufactures	3	4	4	
Magnesium metal including alloys:				
Scrap	--	24	24	
Unwrought	r2,617	2,179	656	Norway 1,517.
Semimanufactures	184	69	69	
Manganese:				
Ore and concentrate	r37,398	29,637	14,831	Australia 14,806.
Oxides	572	122	67	Japan 40.
Mercury 76-pound flasks	r11	82	82	
Molybdenum:				
Ore and concentrate	710	693	631	West Germany 62.
Metal including alloys, all forms	r64	234	222	West Germany 11.
Nickel:				
Oxide	395	320	166	Cuba 71; France 39.
Matte, speiss, similar materials	r2,929	4,411	3,414	France 451; Cuba 204.
Metal including alloys, all forms	236	194	145	France 33.
Platinum-group metals, all forms:				
Palladium troy ounces	r4,273	4,733	568	Switzerland 4,165.
Platinum do.	r360	424	424	
Selenium, elemental kilograms	548	--		
Tin:				
Ore and concentrate	r2,940	2,258	692	Peru 914; Singapore 218.
Oxides	21	129	121	Insignificant.
Metal including alloys, all forms	r276	610	409	Chile 200.
Titanium:				
Ore and concentrate:				
Ilmenite	63,572	59,724	59,724	
Rutile	1,944	2,692	2,198	Australia 457.
Titaniferous slag	37	68	68	
Oxides	668	995	126	West Germany 577; Japan 151.
Tungsten metal including alloys, all forms	24	76	25	West Germany 50.
Vanadium oxides	126	278	198	Switzerland 50; West Germany 15.
Zinc:				
Oxide	199	264	263	Insignificant.
Metal including alloys, all forms	111	575	575	
Zirconium:				
Zircon concentrate	4,719	6,266	5,366	Australia 900.
Oxide	95	148	82	Republic of South Africa 60.
NONMETALS				
Abrasives, natural, n.e.s	r1,410	1,583	1,465	West Germany 47.
Asbestos	r60,359	71,617	8,328	Canada 42,262; Republic of South Africa 11,748.
Barite and witherite	525	98,189	58,809	West Germany 16,372; Singapore 10,998.

See footnotes at end of table.

Table 3.—Mexico: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Boron materials:				
Crude natural borates	429	54	54	
Oxide and acid	r1,054	--		
Clays, crude:				
Bentonite	r4,678	7,782	7,712	Insignificant.
Fire clay	r147,109	162,841	159,164	Do.
Fuller's earth	174	--		
Kaolin	r56,148	71,450	70,744	Insignificant.
Cryolite and chiolite	55	181	106	Denmark 48.
Diamond, gem, not set or strung carats	r785	12,000	10,000	West Germany 1,500; Belgium-Luxembourg 500.
Diatomite and other infusorial earth	r271	228	228	
Feldspar	725	3,434	3,407	Insignificant.
Fertilizer materials:				
Crude, phosphatic thousand tons	1,349	1,196	373	Morocco 823.
Manufactured:				
Potassic	r136,221	154,946	112,936	Canada 21,000; Spain 21,000.
Other including mixed	1,800	3,176	1	Chile 3,175.
Graphite, natural	r114	310	301	Insignificant.
Gypsum	r25,039	26,347	26,276	Do.
Magnesite	4,392	28,794	4,134	Greece 14,262; Brazil 7,000.
Mica:				
Crude including splittings and waste	62	65	59	Insignificant.
Worked including agglomerated splittings	26	549	540	Do.
Precious and semiprecious stones except diamond kilograms	r4,311	236	235	Do.
Quartz, piezoelectric and other crystal do	15,972	104	104	
Salt	1,378	864	864	
Sodium and potassium compounds, n.e.s.:				
Caustic soda	r137,439	265,358	265,148	Insignificant.
Caustic potash	2,014	2,321	1,614	West Germany 333; Italy 236.
Sodium carbonate	104,042	138,835	130,835	Bulgaria 8,000.
Stone, sand and gravel:				
Calcite	1,722	1,658	1,387	France 84; Brazil 80.
Dimension stone: Marble	r4,791	3,314	104	Italy 1,871; Guatemala 1,200.
Dolomite, chiefly refractory-grade	r73	125	115	Insignificant.
Quartz and quartzite except electrical-grade	r1,582	2,115	1,318	Switzerland 448; Sweden 185.
Sand excluding-metal bearing	r331,947	463,033	462,964	Insignificant.
Sulfur, elemental, all forms	r1,109	16,054	16,051	Do.
Talc, steatite, pyrophyllite	r129,866	160,094	160,094	
Vermiculite	r637	683	683	
Other:				
Crude	4,800	NA	NA	NA.
Magnesium oxide	r228	213	169	France 24; West Germany 19.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black and gas carbon:				
Carbon black	2,210	1,924	1,828	Insignificant.
Gas carbon	r140	202	202	
Coal, all grades including briquets	r569,734	741,079	529,439	Australia 88,259; Colombia 63,380.
Coke and semicoke	r86,716	141,718	132,261	Colombia 7,586.
Peat, including peat briquets and litter	177	403	403	
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	44	46	NA	NA.
Kerosine and jet fuel do	193	228	NA	NA.
Distillate fuel oil do	r934	--		
Residual fuel oil do	r6,498	5,593	NA	NA.
Lubricants do	r737	998	NA	NA.
Other:				
Liquefied petroleum gas do	2,155	2,944	NA	NA.
Paraffin do	9	7	NA	NA.
Solvents do	32	51	NA	NA.
Petroleum coke do	6	--		
Unspecified do	12	9	NA	NA.

rRevised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Mexico has no current bauxite production, and there is little prospect for the development of bauxite mines. Alumina, primarily from the United States, is imported as the raw material for the sole producer of aluminum ingot, Aluminio S.A. de C.V., which operated a 90,000-ton-per-year plant in Veracruz since 1963. Because this plant cannot meet domestic demand, imports of aluminum increased notably in 1979 at a cost of $138 million.

Preliminary plans were being made to construct aluminum plants at Altamira to take advantage of its expanded port facilities for importing alumina and the availability there of natural gas as an energy source.

In particular, ALCAN Aluminium Ltd. is to undertake a feasibility study for a 45,000-ton-per-year aluminum smelter in Mexico. The study is a joint venture with Comalum S.A., owned by Mexico's three leading aluminum transmission cable producers. The smelter would be located near Altamira on the Gulf of Mexico and would supply Mexican domestic requirements. If results of the study are favorable and the Mexican Government gives approval, then production could begin within 3 years.

Copper.—Mexico's plans to increase its capacity to produce copper during 1980-90 are shown in table 4.

Mexicana de Cobre, S.A., a joint venture of private Mexican interests (56%) and Government agencies (44%), had its first full year of operation of La Caridad project since startup during the second half of 1979. The new mine operated below capacity because of a number of startup difficulties. The mine, with a design capacity of 72,000 metric tons per day of ore, is the first stage of an integrated project that will include a 180,000-ton-per-year smelter.

Table 4.—Mexico: Projected mine capacity for copper production

(Thousand metric tons)

Company	1980	1982	1984	1986	1988	1990
Mexicana de Cobre, S.A	125	175	175	175	175	175
Cía. Minera de Cananea	55	67	115	147	139	144
Grupo Industrial Minera Mexico, S.A	34	34	34	34	34	34
Minera Frisco, S.A	4	7	7	7	7	7
Macocozac, S.A	4	6	6	6	6	6
Industrias Peñoles, S.A. de C.V	5	5	5	5	5	5
Other	7	9	9	9	9	9
Total	234	303	351	383	375	380
Domestic demand, high estimate	120	173	220	333	505	630

Source: Engineering and Mining Journal. Mining in Mexico. V. 181, No. 11, November 1980, p. 67.

During 1980, construction of the smelter was begun under a construction management contract with Fluor Mining and Metals Inc. Until the smelter is completed, most of the 32% copper concentrate produced will be exported from the Pacific Port of Guaymas.

The La Caridad Mine is located in northwestern Sonora State, about 200 kilometers from Hermosillo. The project is based on a copper deposit of 680 million tons grading 0.6% copper and 0.02% molybdenum with a 30-year operating life. Mine capacity will eventually be increased to 90,000 tons per day of ore to compensate for declining ore grades. The CRM participated in the exploration of the La Caridad copper deposit.

Also in Sonora State, Cía. Minera de Cananea (owned by Fomento Minero, 13%; private Mexican interests, 53%; and Atlantic Richfield Co., 34%) embarked on an expansion program to increase mine and mill capacity from 30,000 to 70,000 tons per day by 1986 at a cost of $250 million. Expansion of smelter capacity was being studied.

Mine production of the Cananea pit was discontinued in 1980. Future mine output from the Cananea project area will come from the Kino and Colorado-Veta open pits and the West Area under development. Major stripping of overburden for the new mine sites was expected to begin in 1982.

Basic engineering for the first-stage expansion of the concentrator, up to 50,000 tons per day, was completed in 1980, and production was scheduled for 1983. The second-stage expansion, up to 70,000 tons per day, was planned for 1984. The Cananea concentrating plant first entered produc-

tion in 1943. In the summer of 1980, a new grinding line in this plant was installed, consisting of a rod mill and two ball mills. The new reverberatory furnace at the Cananea smelter produces a matte of 36% to 40% copper.

The Cananea deposit ranks among the largest porphyry copper deposits in the world. Cananea copper reserves are estimated at 1,850 million tons, with an average grade of 0.7% copper, classified as proven (49%), probable (32%), and possible (19%). A computer model developed in 1972 is being used to evaluate alternate mining plans for the Kino, Colorado-Veta, and West Area pits.

Iron Ore.—Although Mexico currently has installed mine capacity to meet domestic demand for iron ore, it has been necessary to import some iron ore (chiefly from Brazil) because of bottlenecks in the railway system. Imports of iron ore in 1980 amounted to 381,000 tons. There have been shipping delays from the mine to the concentrator or pellet plants and from these plants to the steel companies. Within the 1980's, Mexico's iron ore mine capacity is expected to stabilize at about 15 million tons per year of marketable iron ore. Considering that Mexico's steelmaking capacity is expected to expand to 24 million tons by 1990, it will be increasingly necessary for Mexico to import iron ore. The port expansions planned at Altamira take into account this need for additional iron ore imports.

Table 5 shows that the major iron ore producers are Mexico's integrated steelmakers. In Latin America, Mexico ranks third as an iron ore producer, but second after Brazil in installed capacity for producing iron ore pellets.

Table 5.—Mexico: Major iron ore producers

(Million metric tons)

Company (principal mines)	Proven reserves	Average ore grade	Mine output	Capacity, pellet plant (per year)	Output of concentrate
Consorcio Minero Benito Juarez—Peña Colorado (Peña Colorado Mine)	148	39%	4.5	3.0	--
Altos Hornos de México, S.A. (AHMSA) (La Perla Mine)	50	59%	3.7	[1]6	1.85
HYLSA—Grupo Industrial Alfa (El Encino Mine)	7	NA	3.6	1.5	--
Fundidora de Monterrey, S.A. (FMSA) (Cerro de Mercado and Hercules Mines)	62	NA	2.7	1.4	1.22
Siderúrgica Lázaro Cárdenas-Las Truchas, S.A. (SICARTSA) (Ferrotepec Mine)	60	50%	1.5	1.9	--
Total	327	NA	16.0	8.4	3.07

NA Not available.

[1]A 3-million-ton-per-year pellet plant is to be built by AHMSA at Monclova.

Altos Hornos de México, S.A. (AHMSA) was engaged in a major slurry pipeline and pellet plant project to increase iron ore supply for its steel expansion program. This project will be executed in a joint venture of AHMSA and the Dravo Corp. A 379-kilometer pipeline will transport iron ore from the La Perla Mine on the Chihuahua-Coahuila border to the pellet plant to be built at Monclova. La Perla's current operations produce lump ore, fine ore, and pellets which are shipped by railway to Monclova, northwest of Monterrey, in Coahuila State.

The Consorcio Minero Benito Juarez-Peña Colorado, which started up its second pellet plant in 1979 near Manzanillo, in Colima State on the Pacific coast, was programed to produce 2.2 million iron ore pellets in 1980 and up to its capacity of 3 million pellets in 1981. The two pellet plants received concentrate via two parallel slurry pipelines from the Peña Colorado Mine in northwestern Colima.

In 1980, mine output from Peña Colorado of about 4.5 million tons came from the Espinazo del Diablo ore body and was mined out by yearend. La Encantada I and Anexos a Chula ore bodies were planned for exploitation during 1981 at 5.1 million tons, a level to be maintained by the Consorcio for the balance of the 1980's. The Consorcio is owned by AHMSA (46.5%), Hojalata y Lamina S.A. (HYLSA) (28.5%), Tubos de Acero de México, S.A. (15%), Fundidora de Monterrey, S.A. (FMSA) (5%), and the Secretaría de Patrimonio y Fomento Industrial (5%).

HYLSA-Acero y Tecnologia Siderúrgica produced 2.07 million tons of iron ore in 1980, of which 1.63 million tons was in pellet form. Its El Encino Mine was expected to become exhausted by 1986. HYL-

SA was studying development of an iron ore deposit at Aquila, Michoacán, with projected production of 1.4 million tons per year of feed to be sent to the Alzada pellet plant via a 90-kilometer slurry pipeline.

Iron and Steel.—Although expansion of installed capacity in Mexico's steel industry has generally kept pace with the rapid growth of the economy, actual production has lagged behind domestic demand. The steel industry operated at about 70% of capacity. Apparent steel consumption in 1980 was about 10.2 million tons. In 1979, imports of about 1.6 million tons of steel products valued at $1 billion were necessary. Demands by PEMEX continued to exceed the industry's ability to supply flat and pipe products. With the auto industry projected to grow 10% per year for the next 5 years, no relief of domestic shortage of flat steel products was expected.

Mexico plans to continue the strong growth in the steel industry, such that output is projected to grow to 15 million tons by 1985 and to about 24 million tons by 1990. Demand by 1990 is expected to reach 26 million tons. The Government-controlled steel plants, coordinated under Siderúrgica Mexicana (SIDERMEX) (AHMSA, FMSA, and SICARTSA), were expected to achieve the greatest expansion in capacity, especially SICARTSA.

The SIDERMEX group accounted for about 60% of Mexico's steel output. By 1990, SIDERMEX expected to increase the Government's share of the steel market to 72% after an investment of $18 billion in steel expansion projects.

A new 5-million-ton plant (Steel Plant No. 3) was in the final planning stages, to be located at Altamira, just north of Tampico.

Table 6.—Mexico: Production of crude steel by company

(Million metric tons)

	Capacity	1977	1978	1979	1980[p]	Output share	Change, 1979-80
Siderúrgica Mexicana (SIDERMEX):							
Altos Hornos de México, S.A. (AHMSA)	3,300	2,197	2,447	2,541	2,271	32%	-11%
Fundidora de Monterrey, S.A. (FMSA)	1,500	671	949	888	974	14%	+10%
Siderúrgica Lázaro Cárdenas-Las Truchas S.A. (SICARTSA)	1,100	263	586	646	792	11%	+23%
Hojalata y Lamina, S.A. (HYLSA)	1,600	1,271	1,431	1,548	1,550	22%	+1%
Tubos de Acero de México, S.A. (TAMSA)	430	367	420	420	377	5%	-10%
Semiintegrated plants	[e]1,400	832	942	1,074	1,179	16%	+10%
Total	9,330	5,601	6,775	7,117	7,143	100%	+0.5%

[e]Estimated. [p]Preliminary.

Sources: Instituto Latinoamericano del Fierro y el Acero. Siderurgía Latinoamericana No. 245, September 1980; México '80: Panorama Siderúrgico, pp. 5-15; and National Chamber of the Iron and Steel Industry, (Monterrey), Annual Report 1980.

After 13 years of research and development, HYL, the direct-reduction (DR) technology arm of Mexico's Grupo Industrial Alfa, announced the development of a continuous DR process, having previously only offered its batch process know-how. The new process, named HYL III, requires lower capital and operating costs than any other existing DR process.

The HYL III process will be available in three module sizes: 250,000, 500,000, and 750,000 tons per year. HYLSA will operate one unit of each size at Monterrey. HYLSA's No. 3 DR plant, which is currently a batch plant, is now being converted to the new process and will slightly increase its capacity to 500,000 tons per year. In addition, a new No. 4, 750,000-ton-per-year plant will be built at Monterrey to come onstream by mid-1983.

The HYL III contract signed with SICARTSA will be the first time that a DR unit has been incorporated into a conventional hot-metal integrated steelworks. The Las Truchas steelmaker will install four 500,000-ton-per-year modules.

PREREDUCIDOS Mexicanos S.A., a consortium of 10 Mexican minimill operators, signed an agreement with HYL in September 1980 to supply the two 500,000-ton-per-year DR modules at Altamira Port.

In 1980, Mexico produced 1,636,000 tons of primary iron as sponge iron, or 31% of the total. Mexico continued as the major sponge iron producer in Latin America.

During 1980, a Mexican-Japanese agreement was negotiated to supply financial and technical assistance to Mexico's steel industry in exchange for an increase of oil shipments up to 300,000 barrels per day by 1982. SICARTSA is also included in the basic agreement relative to expansion of the

Las Truchas steel plant. In October, two Mexican-Japanese companies were established to construct and operate a large diameter pipe plant and a casting and forging plant in the Lázaro Cárdenas region.

A total of 55 Mexican and Japanese firms will be involved in the agreement. The Japanese interest will be led by Kobe Steel, Nippon Steel, and the Sumitomo Metal Industries.

Manganese.—The Cía. Minera Autlán, S.A. de C.V., which was formed in 1953, continued as Mexico's major producer of manganese ore and ferroalloys. The manganese carbonate ores are mined in the Molango district of Hidalgo State in the Sierra Madre Oriental. The ore is calcined and nodulized for use in ferroalloys and steel. The nodules of manganese oxide are shipped to Autlán's ferroalloy plants—two in the State of Puebla; one at Tamos, Veracruz; and one in Mobile, Ala. Autlán also exported nodules produced at Molango district to the United States, France, and Japan.

During 1979, Autlán increased its proven reserves from 21.3 to 29.4 million tons of manganese carbonate ores, with an average grade of 27% manganese. Possible reserves are estimated at 1.5 billion tons. Autlán was pursuing an active exploration program in the difficult terrain in Molango.

Autlán's sales of ferroalloys in 1979 increased to a record 168,800 tons, a 22% increase over the prior year. The Mexican steel industry absorbed 62% of the total, and 38% was sold to the United States, Venezuela, and Colombia. Autlán has gained a 7% share of the U.S. market for ferromanganese and a 17% share of the market for silicomanganese. Mexico's demand for ferroalloys was expected to grow to 360,000 tons per year by 1990. Domestic consumption of ferroalloys amounted to 158,000 tons in 1980, while imports of ferroalloys were 11,300 tons.

Mexico's output of nonmetallurgical grades of manganese has been rising and has become the second largest world producer of battery-grade ore, with an output of 37,000 tons in 1979. Autlán is also Mexico's major producer of this raw material from the Cerro Prieto deposits near Nonoalco. Production capacity has been doubled to 30,000 tons per year. Reserves are estimated at 1 million tons of battery-grade ore.

Two other producers in Mexico produce only small tonnages, all of which are for nonmetallurgical applications. Cía. Minera Buena Vista, S.A., has concessions both in the Nonoalco and Molango areas. It mines 12,000 tons per year of ore—some of battery-grade and some a manganous oxide produced by calcination. Cía. Minera San Martín y Anexas produces about 8,000 tons per year of ore, about one-half of which is a 76% MnO_2 battery-grade ore, and the rest is a 60% MnO_2 grade used for chemicals and fertilizers.

Molybdenum.—In the recent past, Mexico has been a negligible producer of molybdenum. Although small relative to world output, Mexican production almost doubled in 1980. The molybdenum recovery project of La Caridad's copper operations and the Cumobabi project of Frisco, S.A. de C.V. offer the prospect that Mexico will become a significant world producer of molybdenum.

The Cumobabi deposit, where stripping of overburden began in early 1979, was being exploited by Minera Cumobabi, S.A. de C.V., a wholly owned subsidiary of Frisco. The copper-molybdenum discovery is located in the La Verde mining district southwest of Cumpas, Sonora State, 190 kilometers south of Cananea.

The 2,000-ton-per-day open pit mining operation at Cumobabi may be expanded to 30,000 tons per day of ore in the future. The Cumobabi concentrator was started up in September 1980, and it produces molybdenum sulfide and copper concentrates. Molymex, S.A. de C.V., another Frisco subsidiary, converts the moly concentrate to molybdenum trioxide at a new roasting plant at Cumpas. Copper concentrate is shipped to smelters outside the mining area.

Proven ore reserves at Cumobabi are estimated at 70 million tons, with an average grade of 0.1% molybdenum and 0.25% copper. Reserves may eventually go beyond 200 million tons.

Silver.—Mexico maintained its position as the leading world producer of silver, continuing a long history of output since the early 1500's. Output in 1980 was well below the record year of 1929 when output reached almost 109 million troy ounces. Excluding petroleum, silver was Mexico's most valuable mineral product ahead of zinc, copper, and lead.

Despite slightly lower production in 1980, Mexico benefited from high prices. Owing to investment demand and speculative activity, the price of silver reached a high of $50 an ounce in mid-January and then collapsed to $10 an ounce in late March. The average price in 1980 was $20.63 an ounce, compared with $11.09 an ounce in 1979 and $5.40 an ounce in 1978. Worldwide, the

excess of production over consumption was absorbed by investors.

Mexico's supply of silver from mine production is expected to increase in the near future as current mines are expanded or new mines developed in response to the historically high prices prevailing in 1980.

Peñoles was Mexico's dominant silver producer in 1980, with a reported output of 34,146,000 troy ounces of refined silver, slightly above the 1979 output, but below its recent high of 34,931,000 troy ounces in 1978. Peñoles accounted for 72% of Mexico's total refined silver output in 1980. From its own mine operations, mainly at the Fresnillo and Naica units, Peñoles produced 1.5 million troy ounces in 1980. The company had record high profits in 1980 and the highest level of silver sales in part because of higher world prices. During 1980, higher prices permitted the working of lower grade silver deposits.

At its Fresnillo Mine, Peñoles continued exploration of new, rich silver veins and began preparations for mining. By yearend, installations were completed at its new Cuale mining unit located near Puerto Vallarta, west of Guadalajara in Jalisco State. The beneficiation plant, with a capacity of 1,200 tons per day, will be able to treat ores with metallic content of silver, gold, lead, zinc, and copper. Cuale is a project of Zimapán, S.A., a subsidiary of Cía. Minera Fresnillo, owned 60% by Peñoles and 40% by AMAX Inc.

Zinc.—Industrial Minera México S.A. (IMM) continued construction of a new zinc refinery in San Luis Potosí, with an annual capacity of 125,000 tons of refined zinc and zinc alloys. The $175 million plant was scheduled for completion in December 1981. IMM is held by Grupo México Desarrollo Industrial Minero S.A. (MEDIMSA), in which ASARCO Incorporated has a 34% interest.

NONMETALS

Barite.—Mexico's demand for barite has increased as a result of increased use of drilling mud for oil exploration and development by PEMEX. Demand for barite by PEMEX increased about 25% in 1980 to an estimated 550,000 tons, one-half of which was imported. New productive capacity installed in 1980 is expected to reduce imports of barite.

During 1980, the Fideicomiso No Metalicos Mexicanos completed installation of Mexico's largest barite operation at Mazatan in Sonora State, about 100 kilometers east of Hermosillo. Barita de Sonora S.A. de C.V., the operating company, planned to begin production in late 1980 at an initial rate of 165,000 tons per year. After expansion in stages, ultimate capacity was expected to reach 330,000 tons per year. Another new operation, with a capacity of 20,000 tons per year, was started up near Acapulco in Guerrero State by Cía. Minera Guadalcazar S.A.

Two major companies already established and producing at the 60,000-ton-per-year level were Baramin de México S.A. in Nuevo León State and Barita de Apatzingan in the States of Michoacán and Puebla.

Fluorspar.—Mexico has the world's largest production capacity for fluorspar and in 1980 accounted for about 20% of world output. It is the country's second most valuable nonmetallic mineral product, after sulfur. Even higher values could be expected as Mexico increases its domestic production of hydrofluoric acid, most of which is exported to the United States. Mexican fluorspar accounts for about 66% of U.S. fluorspar imports.

In addition to the large fluorspar ore producers, there are many small independent mines that sell their ore to the nearest mill or to Reynolds Metals Co. for processing in Texas. Fluorspar is also recovered as a byproduct of sulfide ore concentrators at Minera San Francisco del Oro and Zinc de México. Compañía Minera Las Cuevas, S.A., operating in the State of San Luis Potosí, is one of the major world producers of fluorspar.[7] The company is owned by Noranda Mines Ltd. (49%) and Mexican private interests (51%).

Phosphate.—In late 1980, Roca Fosfórica Mexicana, S.A. de C.V. (ROFOMEX) brought onstream its San Juan de la Costa phosphate mine located in Baja California Sur. Plant capacity is rated at 730,000 tons per year of concentrate. First concentrate production was expected in January 1981. The second ROFOMEX project at Santo Domingo, also located in Baja California Sur, is in the construction phase and should come onstream in mid-1982. These latter deposits are beach sands grading under 5% P_2O_5, compared with the 17% to 18% P_2O_5 ore recovered at San Juan de la Costa. However, the Santo Domingo sands have a 90% liberation of individual phosphate grains, enabling direct feed to the flotation circuit. The sands also contain iron oxide, zircon, titanium minerals, and silica. Plant capacity has been estimated at 1.5 million

tons per year of concentrate containing more than 31% P_2O_5. Later expansions have been planned to increase capacity to 4.5 million tons per year.

The National Commission on Industrial Development, established in July 1979 under the National Industrial Development Plan, has singled out the development of fertilizer materials as one of its priority goals.

Sulfur.—Mexico's leading French-process sulfur producer is APSA, majority owned (96%) by the Mexican Government. The second largest producer is Compañía Exploradora del Istmo S.A. (CEDI), owned by the Government (66%) and Texasgulf Inc. (34%).

APSA operates on the Isthmus of Tehuantepec in southeast Mexico near Jaltipan, Veracruz, where production capacity is about 1.2 million tons per year. In early 1981, APSA plans to bring another plant onstream for production from the Coachapa Dome, also located on the Isthmus near San Cristóbal on the Río Coachapa. APSA's combined capacity from both plants is expected to be about 2.5 million tons per year.

CEDI also operates on the Isthmus of Tehuantepec near the older APSA plant. The CEDI plant has a capacity of 620,000 tons per year.

MINERAL FUELS

In November 1980, Mexico published its national energy plan through the year 1990, including some projections through the year 2000. The preponderance of public attention was placed on those parts of the plan concerning petroleum.[8]

Projections of future electric power generation were also included in the plan. Although past growth in power generation has been about 10% per year, future growth was projected at 12% to 13% per year, with cost being a strong factor in the selection of future plant types. Important roles are foreseen for nuclear, coal, hydro, and geothermal power sources, as well as for traditional oil and gas plants. In 1980, Mexico had 15,130 megawatts of installed electric-generating capacity based on thermal (57%), hydropower (42%), and geothermal (1%) plants.

Nuclear power is expected to contribute 20,000 megawatts to Mexico's electric capacity by the year 2000. Mexico expects to have two nuclear powerplants operational by 1990.

A determination of Mexico's hydroelectric potential and other water resources uses is to be undertaken by the Commission on Energy Sources of the Ministry of Patrimony.

Coal is projected to contribute about 12% to Mexico's overall future power generation. The role of coal in the energy picture has started with the construction of one 1,200-megawatt coal-fired plant, and two more plants of 1,400 megawatts each are planned for the 1980's.

Minimum goals for geothermal energy capacity were established at 620 megawatts by 1990. In 1980, geothermal capacity was 150 megawatts. Possible geothermal capacity increases after 1990 are another area that the commission is expected to investigate.

Estimates for generating costs per kilowatt-hour were calculated for geothermal (1.6 cents), coal (2 cents), hydro (2 cents), nuclear (2.3 cents), and oil (3 cents). Despite the cost-factor importance in determining new electric plant types, oil- and gas-fired plants are expected to dominate and provide a similar proportion of electrical power capacity in 1990 as they did in 1980, that is, over two-thirds of total generation.

Of more concern to world energy markets is Mexico's view of the future economic role of the petroleum sector and the relationship between this energy resource and the external sector. The plan relates that the expansion of hydrocarbon production is a function of the needs of the country and not of the size of reserves or the needs of foreign countries.

For the decade of the 1980's, the new national energy plan proposed an export limit per day of 1.5 million barrels of petroleum and 300 million cubic feet of natural gas. It is hoped to confine the sum of these oil and gas exports to no more than 50% of the value of Mexico's total exports. In 1980, Mexico's exports of crude oil, petroleum products, and natural gas represented 67% of all exports. Furthermore, Mexico hopes to avoid concentrating more than 50% of its hydrocarbon exports to one country, and to keep these exports to an amount below 20% of any country's total imports of petroleum products and crude oil. An exception was made for Central American countries where Mexican petroleum exports may total up to 50% of a country's import needs.

Coal.—In 1980, the Palau coal mine Mimosa II in the State of Coahuila began production. The mine, owned by AHMSA, has reserves of 30 million tons. Coal is mined at an average depth of 270 meters,

and initial extraction is by the longwall method. Production from this mine is expected to be about 1 million tons per year, all of which will be consumed at the Altos Hornos blast furnace in Monclova.

The Conchas Norte coal mine also began production in 1980. This deposit contains an estimated 8 million tons of reserves and is located on the east bank of the Sabinas River in Coahuila State.

The State of Coahuila contains about 90% of Mexico's total proven coal reserves, now estimated at 2.4 billion tons. New Coahuila coal discoveries in 1980 were located in the Rancho de Garcia and Abasolo areas. The coal reserves at Rancho de Garcia cover about 125 acres (9.3 square kilometers) and are divided into three exploitable zones, containing a total 9.7 million tons of coal in situ with the coal-bearing strata averaging 21 meters in thickness. At Abasolo, reserves were estimated at 3.3 million tons in a 200-acre (7-square-kilometer) area with the coal-bearing zone ranging from 27 to 30 meters in thickness. Exploratory drilling in these two areas has not exceeded 50 meters in depth.

Petroleum and Natural Gas.—At the end of 1980, PEMEX estimated proven hydrocarbon reserves at 60.1 billion barrels of crude oil, natural gas liquids, and natural gas equivalents. In early 1981, this figure increased to 67.8 billion barrels. This 31% increase over the 1979 yearend estimate was attributed to the addition of reserves from the Kutz, Ha, and Ek Fields in the Campeche area as well as to revisions of estimates for other fields in this area. The hydrocarbon reserve components include 44.2 billion barrels of crude oil, 3.1 billion barrels of natural gas liquids, and 12.8 billion barrels of dry natural gas liquids equivalent. Mexico's proven crude oil reserves ranked fifth in the world, following Saudi Arabia, Kuwait, Iran, and the U.S.S.R. Proven reserves for 1979-80, by producing area, are shown in table 7. Potential reserves are estimated at 250 billion barrels.

Table 7.—Mexico: Proven hydrocarbon reserves

Zone	Dry natural gas (billion cubic feet)	Petroleum (million 42-gallon barrels)				
		Crude	Condensate	Dry natural gas liquids equivalent	Total 1980[1]	Total 1979
Northern	10,159	445	286	2,030	2,761	3,182
Central[1]	4,013	1,521	202	803	2,526	2,508
Southern	23,607	31,260	1,252	4,723	37,235	22,504
Chicontepec	26,732	10,935	1,323	5,347	17,605	17,608
Total[2] 1980	64,511	44,161	3,063	12,902	60,126	45,803
Total 1979	61,217	30,616	2,944	12,243	XX	45,803

XX Not applicable.
[1]Includes Angostura and Poza Rica.
[2]Data may not add to totals shown because of independent rounding.

Source: Petróleos Mexicanos. Memoria de Labores, 1979, 1980.

In 1980, total crude oil production increased almost 33% over production of 1979, mainly because of a 38% production increase from the Southern Zone, and more specifically from the Cantarell complex in Campeche Sound where the Nohoch and Akal Fields have become highly productive. In 1980, the Southern Zone contributed almost 90% of total crude oil production and 77% of natural gas production. The Central Zone accounted for almost 7% of crude oil production and for 6% of natural gas production. The Northern Zone contributed 3% to crude oil production and 17% of natural gas production. Total petroleum and natural gas production during 1979 and 1980, by region and district, are shown in table 8.

On November 15, 1980, oil production from offshore Campeche reached 1 million barrels per day for the first time, pushing total oil production to 2.3 million barrels per day. Because there was no production from Campeche in 1979, this was a notable achievement for PEMEX.

A total of 349 developmental wells were drilled in 1980, of which 54 were gas, 202 were oil, 35 were for injection, and 58 were abandoned. Gas wells (numbers in parentheses) were drilled in the Reynosa (38), Monclova (9), Central Papaloapan (1), and Comalcalco (6) districts. Oil wells were drilled in the districts of Ebano (12), Cerro Azul (40), Poza Rica (47), Central Papaloapan

(20), El Plan (4), Agua Dulce (19), Comalcalco (30), and Campeche Sound (30).

PEMEX carried out exploration activities in virtually all states, as well as on the Continental Shelf areas of Sinaloa and Oaxaca, the Gulf of Mexico, the Gulf of California, and the Pacific Ocean. In 1980, exploration work resulted in the discovery of 34 fields with potential producing possibilities.

A total of 85 exploratory wells were drilled by PEMEX in 1980, of which 6 produced gas, 29 produced oil, and 50 were abandoned. Gas discoveries were made in the Reynosa and Monclova districts; crude oil discoveries were made in the Cerro Azul, Poza Rica, Comalcalco, and Campeche Sound areas. Other positive exploratory work was carried out in the regions of Michoacán, Guerrero, Tlaxiaco, Oaxaca, Zongolica, Veracruz, Eje de Neovolcanico, Chihuahua, and Baja California. PEMEX continued to employ the latest exploration technology, including the geochemical "Sniffer" method and three-dimensional marine seismic studies.

Table 8.—Mexico: Petroleum and natural gas production

Region and district	Natural gas (million cubic feet)		Crude oil (thousand 42-gallon barrels)	
	1979	1980	1979	1980
Northern Zone:				
Northeastern Frontier	207,466	192,034	284	189
Northern	28,105	20,065	15,481	12,833
Southern	6,826	7,314	7,265	7,006
Total[4]	242,397	219,413	23,030	20,029
Central Zone:				
Poza Rica	59,093	56,238	[1]41,915	[2]42,466
New Golden Lane	3,759	7,147	--	--
Papaloapan Basin	12,228	13,109	3,376	4,432
Total[4]	75,080	76,494	45,292	46,898
Southern Zone:				
Agua Dulce	25,258	23,177	21,612	20,571
Ciudad Pemex	45,479	157,123	40	47
Comalcalco:				
Tertiary	9,563	7,246	9,665	7,856
Mesozoic	[3]637,691	[3]701,039	[3]389,626	365,458
El Plan	19,528	18,271	23,171	21,192
Nanchital	1,241	1,332	2,008	1,893
Gulf of Campeche	8,322	94,486	18,887	224,511
Total	747,082	1,002,674	465,009	641,528
Grand total[4]	1,064,559	1,298,581	533,329	708,454

[1]Includes 38,439 barrels of light crude and 3,476 barrels of heavy crude.
[2]Includes 39,544 barrels of light crude and 2,923 barrels of heavy crude.
[3]Cretaceous.
[4]Data may not add to totals shown because of independent rounding.

Source: Petróleos Mexicanos. Memoria de Labores, 1979, pp. 69-71; 1980, pp. 73-75.

In 1980, the seven major and two minor refineries operated by PEMEX refined an average of almost 1.2 million barrels of crude oil per day, a 19% increase over the 1979 figure. The largest production gains were in liquefied petroleum gas production (33%) and residual fuel oil (29%).

In 1980, Mexico's refining capacity was about 1.3 million barrels per day. An additional 450,000-barrel-per-day capacity will be available when expansions under construction at the Madero (150,000) and Salina Cruz (150,000) refineries are completed. The new national energy plan envisages concentrating refinery investment in facilities to handle the increasing proportion of heavy crude oil in Mexico's crude oil mix to ensure an adequate yield of light products. The plan refers to a doubling of refining capacity of 1990.

In August 1980, Mexico signed an agreement with Venezuela to jointly guarantee nine Central American and Caribbean countries a total of 160,000 barrels per day of crude oil on concessionary terms. The agreement has a 1-year lifespan, with Mexico's contribution to be one-half of each recipient country's crude oil imports and associated financing. Recipients have the option of receiving 30% of the cost of the oil

returned in the form of a 5-year loan at 4% interest. The loan terms can be extended to a 20-year repayment schedule at 2% interest if the proceeds are used for approved development projects, preferably those directed toward developing indigenous energy resources.

One of PEMEX's important fuel-related activities was the December 1980 agreement with Cuba for cooperation in petroleum affairs. The agreement provides for an exchange of petroleum products and derivatives; Mexican technical assistance in expanding the catalytic cracking section of Havana's Nico Lopez refinery to increase production of liquid gas; and a joint offshore exploration program of the continental shelf areas of the Yucatan Peninsula, Caribbean Sea, and an area north of Cuba. Exploration work was expected to begin immediately and include seismic surveys and drilling. This agreement marked PEMEX's first foreign exploratory program. Compañía Mexicana de Exploraciones S.A., a state entity in which PEMEX is majority shareholder, signed a contract to carry out seismic exploration work in Costa Rica.

Uranium and Nuclear Energy.—Mexico was considering both French and Canadian technology and reactors as the foundation for the national nuclear program. Delays in arriving at a decision were because of the need for more data on the extent and quality of Mexico's uranium reserves. This information would influence any decision regarding the more appropriate technology.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Mexican pesos (Mex$) to U.S. dollars at the average rate for 1980 of Mex$22.95=US$1.00.

[3]Petróleos Mexicanos (PEMEX). Memoria de Labores (Annual Report) 1980, p. 6.

[4]Hoagland, A. C., Jr. Company Formation in Mexico. Lloyds Bank International Group, London 1980, Section C.

[5]Secretaría de Patrimonio y Fomento Industrial. La Mineria en Mexico, Mexico City, January 1981, 306 pp.

[6]Work cited in footnote 5.

[7]Industrial Minerals. Mexico's Industrial Minerals-Gathering Momentum. June 1980, pp. 35-42.

[8]Business Trends. Energy Program Sets Long-Range Goals. V. 16, No. 715, Jan. 5, 1981, pp. 1, 8.

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The Mineral Industry of Morocco

By George A. Morgan[1]

The mineral industry contributed about 15% to Morocco's gross domestic product (GDP) in 1980. The country continued to experience balance of payments problems despite increases in worker remittance, tourism, and exports, thus necessitating foreign borrowing. The increases in revenue from phosphate rock exports early in the year were negated for the most part by the high cost of imported fuel. About 80% of the total energy requirements were met by imported fuel; the remainder was derived from coal and hydroelectric power. Cost of imported energy accounted for nearly one-third of total imports. By yearend, the country was the recipient of loans from major financial lending institutions, led by a $1 billion[2] standby credit from the International Monetary Fund. Bilateral loans or grants were also secured, some of which were for military spending. Although the country was not on a war footing, about 40% of the State budget was to be directed to the Western Sahara and defense in 1981, compared with 27% in 1980. The Moroccan Parliament created an exclusive maritime economic zone, extending 200 miles offshore and including the coastal waters of Western Sahara. All resources in, under, and on the surface of the water were given Moroccan sovereignty.

The Government's most ambitious plans continued to be for phosphate fertilizer production and development of indigenous energy resources. About $4 billion was to be spent to expand phosphate fertilizer output by 5% per year to 1985. Capacity to process phosphate rock to fertilizer was to double, utilizing 30% of total output. Port facilities were being expanded to facilitate the additional production. About $1 billion was also planned for exploitation of oil shale over the next 5 years.

PRODUCTION AND TRADE

The index of crude mineral production showed a small decline from the 1979 level. The index for energy production, which included coal, refined petroleum, and electricity, was up slightly for the year. Numerous projects were planned or underway for copper, lead, zinc, and silver mine production, while technical and economic studies continued on a new copper smelter to be built at Agadir. Indigenous energy sources received considerable attention in light of the very high cost of imported fuel and the effect such cost was having on the economy as a whole. Uranium exploration and resource assessment established a number of favorable mining sites, and at least one preliminary report indicated output of some uranium. The uranium was expected to be consumed internally for power generation. Reports relating to bituminous shales indicated that they were amenable to retorting for recovery of heavy oil and for use as direct feed to a boiler because of their self-combustion property.

Although major traditional trading partners continued to be France and Spain, Morocco attempted to establish and maintain bilateral trade relationships with a number of countries such as Japan, the U.S.S.R., the United States, and Iran. Sever-

al trade arrangements involved technical and capital investment in exchange for future production. The country's balance of trade deficit was expected to increase again, and was a continuing source of concern to the Government, which had already implemented restraints to limit imports.

Table 1.—Morocco: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Antimony concentrate:					
Gross weight	3,723	3,355	5,265	4,384	1,278
Metal content	1,405	1,409	2,211	1,973	550
Cobalt concentrate:					
Gross weight	7,185	7,805	8,719	8,008	6,704
Metal content	934	1,015	1,134	961	838
Copper concentrate:					
Gross weight	16,380	12,112	12,217	23,500	24,067
Metal content	[e]4,914	4,845	4,657	7,050	7,220
Iron and steel:					
Iron ore, direct-shipping:					
Gross weight	342,763	441,044	58,938	61,700	78,020
Iron content	215,838	282,268	37,720	39,488	49,933
Metal:					
Pig iron[e]	10,000	12,000	12,000	12,000	12,000
Steel, crude[e]	1,000	[r]5,000	[r]6,000	[r]6,000	6,000
Lead:					
Concentrate:					
Gross weight	98,686	155,685	167,054	165,300	172,320
Metal content	60,198	93,411	100,230	115,710	115,454
Metal:					
Smelter, primary only[e]	[r]26,400	[r]33,200	[r]28,600	[r]35,300	40,300
Refined:					
Primary	26,380	33,136	28,518	35,275	40,261
Secondary[e]	1,600	1,500	1,500	1,500	2,100
Total	27,980	34,636	30,018	36,775	42,361
Manganese ore, largely chemical grade	117,304	113,547	126,200	135,700	131,315
Nickel, Ni content of cobalt ore[e]	146	156	174	[r]160	134
Silver, mine output, metal content thousand troy ounces	2,054	[r]2,820	3,131	3,283	3,154
Tungsten, mine output, metal content kilograms	--	--	--	1,134	3,165
Zinc concentrate:					
Gross weight	29,568	22,153	12,217	12,900	13,798
Metal content	17,740	7,754	4,276	4,515	6,071
NONMETALS					
Barite	129,215	149,920	176,813	286,467	320,585
Cement, hydraulic thousand tons	2,324	2,870	2,819	3,276	3,552
Clays, crude:					
Bentonite	4,664	4,807	4,800	1,015	3,284
Fuller's earth (smectite)	36,768	21,025	8,000	13,586	17,430
Montmorillonite (ghassoul)	3,768	NA	2,065	5,518	4,271
Feldspar	--	--	--	--	1,594
Fluorspar, acid grade	51,450	40,000	54,200	63,200	64,400
Mica	--	--	--	363	331
Mineral water cubic meters	28,064	24,213	20,400	46,007	69,124
Phosphate rock:					
Morocco proper thousand tons	15,656	17,572	19,713	20,000	18,824
Western Sahara do	173	232			
Pigments, mineral: Natural iron oxide (goethite)	14	35	[e]20	25	121
Pyrite and pyrrhotite, gross weight	76,242	149,972	190,400	197,115	124,576
Salt, all types	21,430	12,442	34,813	102,000	67,477
Sulfur, S content of pyrite	[e]22,870	44,992	60,924	63,077	36,052
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite thousand tons	702	707	720	710	680
Fuel briquets do	9,960	7,962	[e]7,000	NA	NA
Gas, natural:					
Gross million cubic feet	1,730	3,037	2,898	2,666	[e]3,000
Marketed do	[e]1,500	3,002	2,800	2,600	[e]2,900
Petroleum:					
Crude thousand 42-gallon barrels	62	167	187	140	[e]365
Refinery products:					
Gasoline do	3,177	3,411	2,017	3,810	2,980
Jet fuel do	594	1,788	1,196	2,028	NA
Kerosine do	1,050	NA	550	506	NA

See footnotes at end of table.

Table 1.—Morocco: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Distillate fuel oil thousand 42-gallon barrels	5,506	5,200	5,081	8,838	8,840
Residual fuel oil ——do	7,524	8,358	9,412	12,399	12,100
Other ——do	1,499	1,070	833	1,783	1,800
Refinery fuel and losses ——do	1,331	1,160	1,126	[e]1,650	NA
Total ——do	20,681	20,987	20,215	31,014	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through July 31, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials is produced, but available information is inadequate to make reliable estimates of output levels.

Table 2.—Morocco: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Waste and scrap	917	1,184	--	France 571; Belgium-Luxembourg 413; United Kingdom 117.
Semimanufactures	100	7	--	Mainly to Belgium-Luxembourg.
Copper:				
Ore and concentrate	10,419	21,272	930	West Germany 7,394; U.S.S.R. 3,931; Finland 2,650.
Matte	--	1,219	--	All to West Germany.
Metal including alloys, waste and scrap	1,461	1,902	--	France 1,111; Belgium-Luxembourg 413; West Germany 130.
Iron and steel:				
Ore and concentrate	39,935	99,686	--	West Germany 25,576; Switzerland 23,170; East Germany 21,230.
Metal:				
Scrap	44,774	88,559	--	Spain 40,584; Italy 36,106; Egypt 6,550.
Steel, primary forms	--	1,700	--	All to Spain.
Semimanufactures	3	406	--	Senegal 331; Mauritania 49.
Lead:				
Ore and concentrate	119,614	118,540	--	France 22,581; Tunisia 16,826; Netherlands 16,711.
Metal including alloys, unwrought	21,335	34,250	--	Italy 14,574; Romania 13,567; India 3,506.
Magnesium metal including alloys, waste and scrap	--	10	--	All to United Kingdom.
Manganese ore and concentrate	140,623	139,351	24,663	France 31,309; Netherlands 21,520; West Germany 16,255.
Silver metal including alloys, unwrought and partly wrought value, thousands	$2,997	$9,255	--	Switzerland $3,840; United Kingdom $2,976; France $2,439.
Tin ore and concentrate	2,294	--		
Tungsten ore and concentrate	5	5	--	All to France.
Zinc:				
Ore and concentrate	15,409	16,317	--	Italy 9,832; France 5,312; United Kingdom 1,173.
Metal including alloys:				
Waste and scrap	--	278	--	Spain 201; France 77.
Semimanufactures	--	7	--	All to France.
Other:				
Ores and concentrates	11,339	10,916	--	France 9,160; Yugoslavia 1,082.
Ash and residue containing nonferrous metals	1,936	567	--	France 459; Spain 75; United Kingdom 33.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum	47	--		
Grinding and polishing wheels and stones ——value	--	$1,000	--	All to France.

See footnotes at end of table.

Table 2.—Morocco: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Barite and witherite	224,842	277,346	100,339	Netherlands 48,896; Norway 48,075; United Kingdom 37,977.
Clays and clay products:				
Crude	20,538	21,721	--	Spain 12,634; Tunisia 2,481.
Products:				
Refractory including nonclay brick	2,363	1,769	--	Lebanon 621; Saudi Arabia 390; Egypt 309.
Nonrefractory	165	170	7	Gabon 64; France 17; Niger 10.
Feldspar and fluorspar	69,823	62,997	--	West Germany 15,925; Norway 13,377; Canada 13,050.
Fertilizer materials:				
Crude, phosphatic _ thousand tons	17,284	17,867	863	Spain 2,823; France 2,321; Belgium-Luxembourg 1,471; Poland 1,126.
Manufactured:				
Phosphatic	171,989	183,995	--	China, mainland 60,000; Burma 29,000; Czechoslovakia 19,359.
Other including mixed	84,210	12,509	--	France 5,250; United Kingdom 5,059; Belgium-Luxembourg 2,200.
Gypsum and plasters	222,233	236,881	--	Nigeria 84,725; Kuwait 51,211; Japan 30,200.
Lime	60	4	NA	NA.
Mica:				
Crude including splittings and waste	556	1,010	--	United Kingdom 510; France 500.
Worked including agglomerated splittings	2	--		
Pigments, mineral, including processed iron oxides	1	1	--	Mainly to Libya.
Precious and semiprecious stones, natural and synthetic _ value	$2,000	--		
Salt	105	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,611	3,809	--	Italy 1,666; France 874; West Germany 388.
Worked	1	1	(1)	Mainly to France.
Gravel and crushed rock	10,724	23,496	NA	NA.
Quartz and quartzite	--	268	NA	NA.
Sand, excluding metal-bearing	5,500	6,991	NA	NA.
Talc, steatite, soapstone	--	250	NA	NA.
Other: Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals	8,169	3,875	--	Liberia 2,450; Nigeria 932; Benin 247.
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades including briquets	56,728	77,622	--	United Kingdom 34,417; Italy 19,885; France 15,900.
Petroleum refinery products:				
Gasoline _ 42-gallon barrels	241,944	1,380,128	--	Netherlands 1,211,768; Spain 164,900.
Kerosine _ do	264	--		
Distillate fuel oil _ do	88,103	93,824	--	All for bunkers.
Residual fuel oil _ do	92,774	128,791	--	Do.
Lubricants _ do	2,058	2,674	--	Do.
Liquefied petroleum gas _ do	--	100,920	--	Italy 38,280; France 25,520; United Kingdom 23,200.
Other _ do	372,421	418,726	--	Mainly for bunkers.

NA Not available.
[1]Less than 1/2 unit.

Table 3.—Morocco: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	780	810	--	All from France.
Oxide and hydroxide	1,725	1,853	--	France 1,405; Italy 403.
Metal including alloys:				
Unwrought	382	331	--	France 327; West Germany 3; United Kingdom 1.
Semimanufactures	4,058	6,585	1,054	France 3,025; Italy 712; Spain 659.
Arsenic trioxide, pentoxide, acid	12	--		
Chromium:				
Ore and concentrate	20	40	--	All from Belgium-Luxembourg.
Oxide and hydroxide	4	16	--	West Germany 10; France 3.
Cobalt oxide and hydroxide	2	1	--	All from Belgium-Luxembourg.
Copper metal including alloys:				
Scrap value	$2,000	--		
Unwrought	205	298	--	All from France.
Semimanufactures	7,266	7,066	2	Spain 3,097; France 1,865; Italy 706.
Iron and steel metal:				
Scrap	1,090	1	1	
Pig iron including cast iron	1,964	625	--	Belgium-Luxembourg 494; France 121; United Kingdom 10.
Sponge iron, powder, shot	210	276	--	France 150; West Germany 77; Sweden 20.
Ferroalloys	329	303	--	France 110; West Germany 100; Portugal 60.
Steel, primary forms	20,600	29,791	--	Italy 13,127; France 8,519; Belgium-Luxembourg 4,502.
Semimanufactures:				
Bars, rods, angles, shapes, sections	336,528	375,930	14	Spain 233,965; France 44,160; Italy 34,966.
Universals, plates, sheets	121,736	120,705	(1)	France 67,277; West Germany 20,058; Belgium-Luxembourg 10,958.
Hoop and strip	20,455	13,097	1	France 9,421; Belgium-Luxembourg 1,104; Spain 810.
Rails and accessories	1,453	4,255	--	France 4,013; Belgium-Luxembourg 144.
Wire	10,743	9,846	--	Belgium-Luxembourg 3,939; France 3,057; Spain 885; West Germany 884.
Tubes, pipes, fittings	17,815	18,471	23	France 6,919; Spain 6,569; West Germany 2,924.
Castings and forgings, rough	486	393	3	France 297; West Germany 63.
Lead:				
Oxides	357	237	--	France 206; West Germany 30.
Metal including alloys:				
Unwrought	6	1	--	All from France.
Semimanufactures	116	179	--	Spain 82; Netherlands 49; France 42.
Magnesium metal including alloys, all forms value	$1,000	$1,000	--	All from West Germany.
Manganese:				
Ore and concentrate	440	475	--	All from Belgium-Luxembourg.
Oxides	208	469	--	Belgium-Luxembourg 427; Ireland 19; Gabon 18.
Mercury 76-pound flasks	116	203	--	China, mainland 145; Spain 58.
Molybdenum metal including alloys, all forms	NA	1	--	Mainly from Poland.
Nickel:				
Matte, speiss, similar materials	8	4	--	France 3; Switzerland 1.
Metal including alloys:				
Scrap	--	1	--	All from United Kingdom.
Unwrought	4	4	--	United Kingdom 3; France 1.
Semimanufactures	847	853	--	West Germany 432; Italy 291; France 87.
Rare-earth metals including alloys, all forms	1	3	3	
Silver metal including alloys, unwrought and partly wrought value	$131,000	$80,000	--	West Germany $52,000; France $13,000; Italy $10,000.
Tantalum metal including alloys, all forms do	$1,000	--		
Tin metal including alloys, all forms	170	175	--	Malaysia 115; Netherlands 22; Thailand 20.
Titanium oxides	2,033	2,445	--	West Germany 957; France 712; United Kingdom 302.

See footnotes at end of table.

Table 3.—Morocco: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tungsten metal including alloys, all forms	(2)	4	--	Mainly from Poland.
Zinc:				
Oxide and peroxide	576	504	--	France 424; Netherlands 54; West Germany 24.
Metal including alloys:				
Blue powder	75	25	--	All from France.
Unwrought	2,800	3,023	--	Belgium-Luxembourg 1,255; Spain 1,038; France 529.
Semimanufactures	426	283	--	France 200; Belgium-Luxembourg 48; Romania 19.
Other:				
Ores and concentrates	35	20	--	All from Belgium-Luxembourg.
Pyrophoric alloys	2	1	--	Mainly from Austria.
Metalloids	16	28	--	Mainly from France.
Base metals including alloys, all forms	3	--		
NONMETALS				
Abrasives, natural, n.e.s.:				
Natural: Pumice, emery, corundum	50	82	--	Italy 37; France 35; Greece 9.
Artificial corundum	27	97	--	France 96; Italy 1.
Dust and powder of precious and semiprecious stones, value	$1,000	--		
Grinding and polishing wheels and stones	610	685	--	Italy 508; France 107.
Asbestos	5,649	4,756	215	Canada 642; West Germany 501; New Zealand 400.
Boron materials:				
Crude natural borates	477	700	700	
Borate and perborates	169	182	--	Spain 57; West Germany 50; France 35.
Oxide and acid	6	21	--	Belgium-Luxembourg 8; France 8.
Cement	936,489	539,685	--	Spain 376,829; Poland 121,977; France 37,863.
Chalk	6,655	7,597	--	France 5,793; Spain 1,463; Belgium-Luxembourg 315.
Clays and clay products:				
Crude	9,728	11,385	7	France 6,606; United Kingdom 2,326; Guyana 2,000.
Products:				
Refractory including nonclay brick	7,145	6,257	--	Spain 2,696; France 1,386; West Germany 1,338.
Nonrefractory	13,077	14,502	--	Italy 5,807; Spain 5,309; France 1,393.
Diamond, industrial, value	$4,000	$21,000	--	All from West Germany.
Diatomite and other infusorial earth	405	176	--	Spain 136; West Germany 21.
Feldspar and fluorspar	20	108	--	France 84; West Germany 24.
Fertilizer materials:				
Crude:				
Nitrogenous	--	50	--	All from West Germany.
Phosphatic	10	--		
Manufactured:				
Nitrogenous	187,245	252,647	--	West Germany 95,809; France 55,087; Romania 46,087.
Phosphatic, value	--	$4,000	--	All from United Kingdom.
Potassic	53,718	82,836	--	Spain 33,129; East Germany 29,718; Belgium-Luxembourg 13,982.
Other including mixed	96	27,326	5	Spain 15,000; France 6,006; Netherlands 6,000.
Ammonia	33,235	32,091	4,025	U.S.S.R. 20,667; Netherlands 3,036; Venezuela 2,762.
Graphite:				
Natural	13	--		
Artificial	1	9	--	All from France.
Gypsum and plasters	--	15	--	Do.
Lime	2,550	900	--	Do.
Magnesite	125	109	(1)	Mainly from Austria.
Mica:				
Crude including splittings and waste	19	15	5	France 5; Norway 5.
Worked including agglomerated splittings	1	13	--	France 11; Spain 1.
Pigments, mineral:				
Natural, crude	325	270	--	France 245; Spain 25.
Iron oxides, processed	839	829	--	West Germany 435; United Kingdom 206; Spain 84.
Precious and semiprecious stones, synthetic, value	$29,000	$2,000	--	All from France.

See footnotes at end of table.

Table 3.—Morocco: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Pyrite, unroasted	40	--		
Salt	9,103	9,454	--	Tunisia 9,450; France 2; West Germany 2.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	4,621	8,466	--	France 7,618; Italy 844.
Caustic potash	195	349	--	West Germany 142; France 109; Italy 68; Spain 30.
Soda ash	5,106	3,457	--	France 2,800; U.S.S.R. 350; Bulgaria 250.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	852	--		
Worked	1,484	328	--	Italy 298; France 15; West Germany 15.
Dolomite, chiefly refractory grade	1,374	313	--	France 303; Austria 10.
Gravel and crushed rock	103	95	--	Belgium-Luxembourg 54; Spain 24; Italy 15.
Quartz and quartzite	5	53	--	France 41; West Germany 7; Spain 5.
Sand, excluding metal-bearing	20,936	24,250	--	Belgium-Luxembourg 22,810; Portugal 1,200.
Sulfur:				
Elemental	374,538	587,559	179,342	Poland 242,485; Canada 131,792.
Sulfur dioxide	60	NA	--	All from France.
Sulfuric acid	6	14	--	West Germany 7; Belgium-Luxembourg 6; France 1.
Talc, steatite, soapstone, pyrophyllite	936	797	--	France 721; Spain 50; China, mainland 20.
Other:				
Crude	161	--		
Oxides, hydroxides, peroxides of magnesium, strontium, barium	24	16	--	France 11; West Germany 5.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals	299	76	--	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	43	9	7	France 2.
Carbon black	4,456	4,270	--	France 1,388; United Kingdom 1,295; Spain 1,247.
Coal, all grades	7,860	10,474	--	West Germany 9,242; Poland 1,232.
Coke and semicoke	18,152	28,703	--	Italy 16,049; West Germany 9,354.
Hydrogen, helium, rare gases	26	45	--	France 24; United Kingdom 16; Spain 3; Italy 2.
Peat including briquets and litter	2,114	4,537	--	Netherlands 4,153; West Germany 384.
Petroleum and refinery products:				
Crude				
thousand 42-gallon barrels	21,272	33,640	--	Iraq 18,722; Saudi Arabia 7,567; U.S.S.R. 4,061.
Refinery products:				
Gasoline ---do---	(1)	20	--	Mainly from Italy.
Kerosine and white spirit ---do---	58	52	--	Netherlands 42; Belgium-Luxembourg 9.
Distillate fuel oil ---do---	2,653	349	(1)	United Kingdom 163; France 148.
Residual fuel oil ---do---	1,393	9	--	All from Romania.
Lubricants ---do---	391	292	1	France 234; Venezuela 33.
Other:				
Liquefied petroleum gas ---do---	2,099	1,553	--	France 716; Italy 313; Netherlands 152.
Mineral jelly and wax ---do---	104	118	(1)	Greece 54; Spain 29.
Nonlubricating oils ---do---	317	68	--	Italy 32; Netherlands 23.
Bitumen and other residues ---do---	9	100	--	Spain 81; Belgium-Luxembourg 12.
Bituminous mixtures ---do---	2	3	--	France 2.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	884	1,252	--	Netherlands 465; Spain 403; West Germany 166.

NA Not available.
[1]Less than 1/2 unit.
[2]Quantity unreported; imports valued at $42,000.

COMMODITY REVIEW

METALS

Antimony.—About 170 occurrences of the metal have been recorded, mainly in the north and north-central part of the country. Bureau de Recherches Géologiques et Minières (BRGM) of France has provided technical assistance to the Directorate of Mines for assessing antimony resources since the conclusion of a bilateral cooperative agreement in 1977. A geologic study was underway which was to provide exploration targets for determining additional reserves of antimony. The work was to be performed by the holders of mineral rights, and a treatment process adapted to the ore was to be tested in a pilot plant.

Copper.—Output of copper ore was relatively stable in 1980 following a near doubling of production between 1978-79. Lower copper prices and increased operating costs were the causes for the decline. The new underground copper mine at Bleida came into operation in 1979. When fully operational, production at the mine would be about 54,000 tons per year of copper concentrate grading 32% copper.[3] Overall reserves at the site were put at 2.5 million tons grading 7.5% copper. Nearly all output in Morocco was exported as concentrates. The following tabulation lists mines in operation in 1979, along with quantity and value of copper concentrates produced.[4]

Mine	Quantity (tons)	Value (thousand dollars)
Ouansimi	11,971	4,580
Bleida	6,973	2,805
Tazalaght	2,156	1,178
Assif Imider	1,732	1,356
Tanfif	370	103
Taourirt	171	31
Taliouine	110	3
Imililte	40	12
Total	23,523	10,068

Some copper production was also realized as a byproduct of lead-copper mining at Beddiane by Campagnie Minière de Touissit (CMT). Production at Bleida has largely offset the loss of output which occurred in 1977 and 1978 owing to the closure of the Bous Kour, Talaat N'Ouamane, and Tannsriff Mines.

Preliminary technical and economic studies continued on the planned 50,000-ton-per-year copper smelter at the Port of Agadir, which was to treat both domestic and imported concentrates. The Bleida deposit was to be the source for the domestic material, while 110,000 tons per year of concentrate containing 27% copper would be imported. Production would include gold, silver, and sulfur, and total employment upon completion was to be 350 people.[5]

About $3.4 million has been spent thus far on the Tizert copper-silver project in Agadir. Total reserves were 3 million tons grading 1.69% copper and 1.7 ounces of silver per ton. First-phase development would involve production of 84,000 tons per year of ore yielding 4,000 tons per year of concentrate containing 40% copper and 31 troy ounces of silver per ton. Overall cost of the project was estimated at $12.3 million, and when completed it will employ 150 people.

Iron and Steel.—The first stage of a steel mill to be constructed at Nador was to have a capacity of 360,000 tons per year of wire and bars for concrete reinforcement. Société Nationale de Siderurgie was to be the operator, with production expected to commence in 1983. Ultimate capacity at the plant would be 1 million tons per year.[6]

Lead and Zinc.—About 75% of the lead produced in Morocco was exported as concentrates. The remainder, about 40,000 tons, was smelted locally at Oued El Heimer and exported as primary metal. Total receipts from lead exports were valued at $112 million in 1979. The following tabulation lists mines and mining groups according to level of output of concentrates in 1979.[7]

Mines and/or organization	Quantity (tons)
Beddiane, Oued Mekta	70,000
Zeida	44,640
Djebel Aouam	18,600
CADETAF	14,000
Aouli, Mibladen	8,600
Adrar	6,400
Draa Sfar	3,060
Total	165,300

Production at the Beddiane and Oued Mekta Mines in Oujda Province near Touissit was by CMT. About 750 people were employed at the mining operations at Touissit. Data for Central d'Achat et Developpement de la Region Minière du Tafilalet et de Figuig, a mining cooperative, include production from small mines and artisanal workers at Tafilalet and Figuig.

Technical, economic, and commercial studies were completed for a lead smelter to be built at Midelt for Fonderie Centrale de Plombe. Feed to the smelter was to be

100,000 tons per year of lead concentrate, containing 68% lead with silver and copper byproducts. Annual output would include 70,000 tons of lead, 1.6 million troy ounces of silver, and 560 tons of 45% copper concentrate. Offers for construction of the smelter had been received and were under review.

Feasibility studies for exploitation of the lead-zinc deposit at Bou Madine in Errachida Province were completed. Reserves were 6 million tons grading 1.3% lead, 5% zinc, and 4.8 troy ounces of silver per ton. Initial production for the first phase of operations was to be 60,000 tons per year of crude ore, with a work force of 120 people.

Exploration conducted about 18 kilometers east of Chaouen revealed two potentially exploitable zinc deposits. The Cadnar deposit had reserves of 7.5 million tons grading 3% zinc, with a potential of 40 million tons of ore indicated. The Khemis Tikenziguen deposit, although of limited tonnage, contained 10% zinc with associated germanium and cadmium. Pilot-plant metallurgical studies on ore samples from both sites yielded concentrates grading 50% zinc.

The Arab Mining Co. had a 40% interest and the Bureau de Recherches et de Participations Minières (BRPM) had a 60% interest in a lead-silver mine which was to be opened at Sidi Lahcen at a cost of $11.5 million. Ore reserves were estimated at 1 million tons, while output from the mine was to be 84,000 tons per year of crude ore grading 5.5% lead, 0.8% zinc, and 0.2% silver.[8]

Silver.—Production of silver in Morocco has been from the Imiter Mine in the Ouarzazate region and from lead ores smelted at Oued El Heimer. The Imiter deposit had proved reserves of 2.4 million ounces of silver. Production was in the form of a precipitate containing 92% silver. Several million tons of additional ore were inferred in the area.

The Zgounder deposit, northwest of Sirwa, had reserves of 600,000 tons grading 16 troy ounces of silver per ton. The deposit was being developed by the Société Metallurgique du Sirwa, which was 40% controlled by Arab Mining Co. and 60% by BRPM. Production of 56,000 tons of ore per year was planned for Zgounder, yielding about 830,000 troy ounces of silver. Cost of the project was estimated at $11 million.

Tungsten.—Joint exploration conducted by BRPM and Klöckner in Marrakech Province resulted in several finds of extensive scheelite mineralization. At Azegour, 500,000 tons of rock grading 0.20% WO_3 were reported, while at Sidi Bou Azzouz, 160 kilometers south of Casablanca, 1 million tons grading 0.25% WO_3 were found. Both sites were in the final stages of feasibility and engineering studies as potential mining projects.

Exploration drilling was underway at Taourirt N'Tamelalt in Ouarzazate Province and at Zguit in Khemisset Province. Preliminary estimate of scheelite mineralization at Taourirt N'Tamelalt was 800,000 tons grading 0.20% WO_3.

Uranium.—An assessment of uranium resources in Morocco has been underway to evaluate potential exploitable ore for expanding the country's energy base. At Jbel Waffaga, in the Western High Atlas, 2,000 tons of uranium (U) as carnotite and pitchblende in ore grading 0.15% to 0.2% U_3O_8 were recorded. At Assaka, in the Anti Atlas Mountains, uranium was found in fractures and alteration zones of Precambrian granites. The deposit was considered to have 4,000 tons of uranium in ore grading 0.15% U_3O_8. At Akka Bou Tiouit, 570 kilometers east of Agadir, a potential of 2,000 tons of uranium in ore grading 0.075% U_3O_8 was reported. Exploration of the Ouarzazate Tertiary Basin was planned based on geologic evidence of uraniferous sediments derived from the Precambrian rocks of the High Atlas and Anti Atlas.

NONMETALS

Fluorspar.—Geological and production feasibility studies were completed on the Zrahina fluorspar deposit near Khenifra. Reserves were 1 million tons grading 31% fluorite, 11% barite, 1.83% lead, 0.6% zinc, and 2 ounces of silver per ton. Operation of the deposit would involve an annual output of 70,000 tons of ore yielding 14,700 tons of 96% fluorite, 3,500 tons of barite, and 1,400 tons of concentrate containing 65% lead and 64 ounces of silver per ton.

Magnesite.—A magnesite-bearing zone, located 60 kilometers south of Ceuta, was the subject of exploratory drilling which indicated reserves of 9 million tons of material grading 43% magnesia. One million tons was reported to have a grade exceeding 44.5% magnesia, with a portion of the zone extractable by openpit mining.

Phosphate Rock.—At the Youssoufia phosphate mining center on the Ganntour Plateau, white phosphate rock was pro-

duced for direct export through the Port of Safi and to supply the fertilizer plants of Maroc Chemie I and II and Maroc Phosphore I at Safi. White phosphate was expected to become relatively less important as production of black phosphate rock at Youssoufia expanded. Black phosphate was produced from Bed I and calcined at 750° C to produce 75% bone phosphate of lime. The largest expansion at Youssoufia was to be for black phosphate from new underground workings as at Recette 7. Production from new Ben Guerir Mine, also on the Ganntour Plateau, was destined solely for the new Maroc Phosphore II fertilizer plant at Safi. About 23 phosphate-bearing beds were identified at Ben Guerir, with 20 beds potentially exploitable.

At the Khouribga mining area on the Oulad-Abdoun Plateau, phosphate rock from Bed I was nearly exhausted. Beds O, I, and II, formerly mined selectively, were mined together which allowed for the use of larger and more economical draglines for exploitation. Selective mining of high-grade lenses of phosphate material overlying the main beds occurred at Meraa al Arech. The mining of Bed III was restricted by the availability of water, while overburden stripped from current operations was being dumped on the bed. Geologic studies and ore beneficiation tests were also underway at Sidi Hajjaj, west of Khouribga on the Oulad-Abdoun Plateau. Output was to be used as feed to the phosphoric acid plant at Jorf Lasfar.[9]

Production of phosphoric acid was centered at Safi where Maroc Chemie I and II and Maroc Phosphore I were operational. Maroc Phosphore II was built at Safi, with three sulfuric acid and one phosphoric acid stream. Output of phosphoric acid from Maroc Chemie I and II was mainly used for further downstream processing, while production from Maroc Phosphore I was exported primarily as 54% phosphoric acid. Output from Maroc Phosphore II was designated for export. Civil engineering work on the Port of Jorf Lasfar resumed following a temporary suspension in 1979. Full operation of the port was planned for 1983, at which time equipment for the new phosphoric acid plants to be built at the port would be shipped in. Phosphoric acid and phosphate fertilizer facilities were also planned for the Port of Nador. Phosphate rock supplies for Nador would be shipped by sea from Jorf Lasfar.

Overall loading capacity for phosphate rock at the Ports of Casablanca and Safi was 25 million tons, and was expected to be insufficient in view of production expansion plans for the industry by 1985. Upgrading of raw phosphate rock to phosphoric acid of fertilizer at Safi, Jorf Lasfar, and Nador was expected to account for about 30% of total P_2O_5 produced compared with 12% currently. New capacity may reach 37 million tons by 1985 compared with 24 million tons in 1980. Marphocean, a Moroccan shipping line 46% controlled by Office Cherifien des Phosphate, had four 27,000 deadweight tons (dwt) vessels and two 11,000 dwt vessels for use in phosphate fertilizer operations. Orders have been placed for two 24,000 dwt and two 6,600 dwt vessels from Chantiers Naval de Dunkerque of France.[10]

MINERAL FUELS

Bituminous Shale.—Research on oil shale processing increased as more effort was made to attract investor interest in development projects. BRPM operated two small retorts at Timhadit for testing heavy oil recovery. Two pilot plants with capacities of 80 and 100 tons were to be completed in 1981 for testing recovery processes on a larger scale. Reserves at the Timhadit oil shale deposit were estimated at 20 billion tons, yielding about 17 gallons of heavy oil per ton of shale.

Natural Gas.—New gas finds were made near Mechra bel Ksiri in the Gharb Basin. An oil and gas discovery was also made by BRPM at Meskala in Essaouira Province. If commercial, the additional output could be tied into existing production lines. BRPM, Elf Aquitaine Maroc, and the Société Cherifienne des Petroles (SCP) were to continue their exploration in the Pre Rif in 1981 with the assistance of the Kuwait Petroleum Corp.

Petroleum.—Elf Aquitaine and SCP were awarded five oil prospecting permits covering a portion of the Gharb area and the foothills of the Rif Mountains. The project, estimated to cost $90 million, was to be conducted in association with BRPM which received a $50 million loan from the World Bank for petroleum exploration. Actual work was to entail 36 months of seismic study and the drilling of 17 exploratory wells. The loan was for a 10-year term with 4 years of grace, at 8.25% interest per year. The Islamic Development Bank granted a loan of $15 million to finance the purchase of crude oil. Actual terms of the agreement were not released.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been coverted from Moroccan dirhams (DH) to U.S. dollars at the rate of DH3.75=US$1.00 for 1979 and DH 4.33=US$1.00 for 1980.

[3]World Mining Newsletter. New Copper Mine. V. 33, No. 3, March 1981, p. 7.

[4]Bangue Morocaine du Commerce Exterieur. Copper. Monthly Information Review. No. 32, January-February 1981, 412 pp.

[5]Bureau de Recherches et de Participations Minières. Mining Projects Presented by BRPM. January 1981, 24 pp.

[6]Mining Magazine. Moroccan Steel Mill Go Ahead. V. 142, No. 2, January 1980, p. 169.

[7]Bangue Morocaine du Commerce Exterieur. Monthly Information Review. No. 31, November-December 1980, pp. 11-14.

[8]World Business Weekly. New Mines In Morocco. V. 4, No. 9, Mar. 9, 1981, p. 43.

[9]Phosphorus and Potassium (London). Phosphate Deposits in Morocco. No. 105, January-February 1980, pp. 21-26.

[10]———. OCP Unveils Plans for the 1980's, part 2. No. 106, March-April 1980, pp. 34-39.

The Mineral Industry of Mozambique

By Miller W. Ellis[1]

Since Mozambique became independent on June 25, 1975, most of the 250,000 Portuguese who dominated the industry, trade, and commercial aspects of the country's farming have departed. The subsequent closure of the Rhodesia-Mozambique border was followed by a stagnating economy and despite aid, chiefly from Western Europe, there were few indications of economic recovery until the end of the conflict in neighboring Rhodesia-Zimbabwe. Following the exodus of thousands of small industrialists and shopkeepers, their enterprises were nationalized and run by the Government of the People's Republic of Mozambique (GPRM) with indifferent success. In successive speeches on February 27 and March 18, 1980, the country's President called on Western capital to rescue the country's economy and on the former owners of nationalized enterprises to return to Mozambique and resume their management. He also invited the investment of capital from the United States and other Western nations in Mozambique projects. Despite the reiteration of these invitations during the remainder of 1980, there were many other events that indicated the continuing strong affiliation of the GPRM with the centrally planned economies of Eastern Europe.

On February 12, 1980, the newspaper, Noticias da Beira, reported that a 30-member expedition of scientists from the U.S.S.R. stopped at Maputo on their way to Antarctica as part of the first Soviet air expedition to that subcontinent. The expedition was to make a detailed study of the Molodezhnaya polar station and to determine the feasibility of constructing another airfield at the Mirnyy station. Those stations were about 4,670 kilometers from a staging base established at Maputo, approximately 8 hours flight for the IL-18-D aircraft.

From February 24 to February 27, 1980, the Bank of Mozambique acted as host and organized a "Round Table on Western Investment in Mozambique," arranged by Business International (BI) for delegates from 22 firms in 8 countries. The delegates were addressed by the President of the GPRM, and by several Ministers including the Secretary of State for Coal, Gas, and Oil, as well as the Agriculture Minister and the Secretary of State for Fisheries. The delegates were reportedly favorably impressed by the country's economic potential but had reservations about current investment because of the dearth of hard economic data and the conspicuous lack of trained personnel to staff new undertakings. The GPRM's vagueness about terms and conditions of investment, profit margins, and repatriation (to be arranged on a case-by-case basis), produced some skepticism on the part of the delegates that the GPRM was ready to make the necessary adjustments in order for Mozambique to become a favored environment for Western investment.

In a speech at a political rally on March 22, the President stated that the efficiency of small businesses had fallen below acceptable standards because of excessive state involvement. The GPRM was ready to restore nationalized industries and businesses to their former owners. Portuguese nationals who had left Mozambique were encouraged to return and resume their former activities. Western investment in Mozambique enterprises was to be encouraged.

On July 12, 1980, the Electricidade de Mocambique invited tenders for implementing the second stage of the Cabora Bassa

hydroelectric power project. The Cabora Bassa first stage was started in 1967 and was completed 10 years later. It comprised a 170-meter-high reinforced concrete dam wall, impounding a 60-billion-cubic-meter reservoir, 250 kilometers long and 30 kilometers wide at its widest point. It has five generator groups with a unit capacity of 415 megawatts each (total 2,075 megawatts), and the complex was valued at $656.2 million. Most of the output was fed through two direct current high-tension lines to consumers in the Republic of South Africa, 1,440 kilometers to the south. The Maputo area, Tete, and the Moatize coal mining center also received power from Cabora Bassa. Stage II plans included an underground power station in the north bank of the Zambezi River with about 1,750 megawatts capacity and power transmission lines to all parts of the country. The Maputo thermal powerplant has supplanted diesel generators for the supply of electricity to the Costa do Sol tourist district and adjacent fishing area a few kilometers from the city. In June, the two thermal generators supplying electricity to the Chimoio area, 75 kilometers east of Umtali, Zimbabwe, were destroyed by an explosion. Since that time, the Umtali thermal power station has been exporting up to 20 megawatts of power to Chimoio.

The anti-Frelimo Mozambique National Resistance Movement was blamed for the closure of the Umtali-Beira Railroad from September 20 to October 3 and for increased guerrilla activity in the western part of the country in the latter part of 1980. Despite the October signing of a security pact between the GPRM and the new Government of Zimbabwe, the direct current, high-tension line transmitting power from the Cabora Bassa Dam to the Republic of South Africa was cut on December 9, 1980.

A study entitled "Economic Justification for a Comprehensive Mineral Resource Program for Mozambique" was commissioned by GPRM in 1980. The study outlined a comprehensive airborne geophysical survey of 423,500 square kilometers and appropriate followup strategies, with an overall cost of $32.5 million. It was speculated that the survey could produce investments in Mozambique's mineral sector on the order of $313 million and sales revenues on the order of $5.3 billion over a period of 35 years. Such an increase in mineral development would increase the average rate of growth in gross domestic product (GDP) by about 16% during the next 20 years. Under the medium mineral development scenario, mineral exports were projected to increase by $155 million per year in a decade and by $290 million per year in 20 years.

The Mozambique National Geology Board has awarded a $15 million contract to Aquator, part of the Italian Ente Nazionale Idrocarburi (ENI) group. The work involved geochemical survey of a 19,000-square-kilometer area and geological mapping at a scale of 1:50,000, as well as geochemical sampling of another 29,000 square kilometers with mapping at 1:250,000 scale in the Zambezi and Nampula regions. Two French companies were also awarded a 2 1/2 year contract for surveys in the northern Provinces of Niassa and Cabo Delgado. They were Bureau de Recherches Geologiques et Minieres (BRGM) and Compagnie General de Geophysique. It was reported that about 100 young Mozambicans were being trained in electrical and various other aspects of mining engineering in the German Democratic Republic. Meanwhile, a professional training center was under construction at Moatize, in Tete Province.

PRODUCTION AND TRADE

Fragmentary reports of production of Mozambique's mineral commodities have been used to compile the production estimates shown in table 1.

In 1980, Mozambique's largest import commodity and supplier was petroleum from Iraq, which made up 17.7% of the country's total import costs. Imports from the Republic of South Africa for 1980 were valued at $103 million and composed 14.4% of the total. Mozambique exports to the Republic of South Africa totaled only $12 million. Figures released by the GPRM National Planning Commission indicate that imported crude and refined petroleum products in 1979 were valued at U.S. $116 million, or nearly one-fifth of the country's total imports for that year. Petroleum exports during the same year were valued at $37 million, and transit operations through the ports of Beira and Maputo, of petroleum destined for Malawi, Swaziland, and the Republic of South Africa, earned an additional $20 million to $25 million.

Table 1.—Mozambique: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum: Bauxite, gross weight	2,000	2,000	--	--	--
Beryllium: Beryl concentrate, gross weight	(3)	NA	NA	28	20
Columbium and tantalum ores and concentrates, gross weight:					
Columbite[e] kilograms	1,700	2,300	2,300	2,300	NA
Microlite do	55,921	39,866	39,866	[e]31,750	NA
Tantalite[e] do	28,000	36,300	36,300	31,750	NA
Copper, mine output, salable ore and concentrate:					
Gross weight	--	--	460	1,125	1,000
Metal content	--	--	130	225	200
NONMETALS					
Asbestos, anthophyllite	--	--	--	789	800
Cement, hydraulic thousand tons	217	323	[e]327	273	275
Clays:					
Bentonite (including montmorillonite)	2,298	2,744	[e]3,000	1,656	1,500
Kaolin (including china clay):					
Crude	--	--	--	223	200
Washed	--	--	--	139	100
Feldspar[e]	850	900	900	--	--
Gem and ornamental stones:					
Beryl crystals kilograms	32	14	15	1,920	2,000
Garnet do	2,360	1,871	2,000	11,200	12,000
Tourmaline do	25	26	25	NA	NA
Lime, hydraulic[e]	100,000	100,000	10,000	10,000	10,000
Lithium minerals:[e]					
Lepidolite	730	--	--	--	--
Spodumene	25	--	--	--	--
Mica, mainly scrap	900	800	[e]900	251	200
Salt, marine	28,000	28,000	[e]28,000	[e]28,000	28,000
Sulfuric acid	15,300	18,750	NA	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	553	310	118	320	[4]408
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	473	621	510	NA	NA
Kerosine do	195	178	296	NA	NA
Jet fuel do	56	128			
Distillate fuel oil do	613	865	634	NA	NA
Residual fuel oil do	1,003	1,438	1,132	NA	NA
Other do	167	63	85	NA	NA
Refinery fuel and losses do	278	299	270	NA	NA
Total do	2,785	3,592	2,927	NA	NA

[e]Estimated. [p]Preliminary. NA Not available.

[1]Table includes data available through July 2, 1981.

[2]In addition to the commodities listed, crude construction materials and additional varieties of gem and ornamental stones presumably are produced, chiefly for local consumption, but information is inadequate to make reliable estimates of output levels.

[3]Less than 1/2 unit.

[4]Reported figure.

The following table shows the number of ships and the amount of freight moved through Mozambique's major ports, January through December of 1979 and 1980.

Port	Ships		Thousand tons	
	1979	1980	1979	1980
Maputo	808	928	4,030	4,063
Matola[1]	244	212	4,107	3,540
Beira	770	528	1,722	1,520
Nacala	229	218	784	752

[1]The Matola port was built in 1964 as an annex to the port of Maputo (formerly Lorenzo Marques) to handle bulk liquid fuels and bulk minerals.

By mid-1980, plans were announced for a $515 million program of extensions to Maputo harbor, the country's major port. Initially, South African contractors were to add 2.2 million tons of coal export capacity per year to the existing facilities. Subsequent work was to involve overseas contractors and construction of a new port to export 6.5 million tons of coal annually, for completion in 2 years. The port of Nacala in the northeastern part of the country is one of Africa's best natural Indian Ocean harbors, and upgrading was in hand, as was rehabilitation of the railroad line to Malawi. Nacala harbor has been specifically equipped for handling the roll-on, roll-off container freight that has become popular. The 1980 quota for Nacala harbor of handling 3,000 containers was exceeded by 300%.

The railway line connecting Maputo's ports with the Republic of South Africa was the first to be renovated for increased traffic. Heavier weight rails at 54-kilograms-per-meter length were installed in place of the old intermediate weight 45-kilograms-per-meter length rail. The Caminhos de Ferro Mocambique (CFM) established a fabricating plant at its Machava yard, between Maputo and Matola, where the normal 12- to 18-meter lengths of rail were flash butt-welded into 144-meter continuous lengths as they were loaded on a track-laying unit for transport up the line toward the town of Ressano-Garcia at the Mozambique-South African border. Each 144-meter length was then thermite-welded in place on new reinforced concrete crossties or sleepers, and the track was leveled and reballasted to carry greater loads at faster speeds. Lightweight (30-kilograms-per-meter) rails on the shunting or switching tracks were also replaced with 45-kilograms-per-meter rail on concrete ties. The first freight train from Zimbabwe to Maputo since February 1976 arrived at the port in early October 1980, but extensive repairs necessary for full-time resumption of service included relaying heavier rail on new concrete sleepers on much of the line and repairing a number of bridges. In the northern part of the country, some 600 kilometers of antiquated railroad track west from Nacala was also slated for renovation, including replacement of 30-kilograms-per-meter rail with heavier 45-kilograms-per-meter rail laid on concrete sleepers.

COMMODITY REVIEW

METALS

Tantalum.—Delegations led by the GPRM Minister of Public Works and Housing and the German Democratic Republic's Minister for Ore Mining met in Quelimane on July 6, 1980, for discussions before visiting the Muiane, Marropino, and Morrua tantalum-rich pegmatite deposits, 200 kilometers to the northeast. Subsequently, an agreement was signed whereby exploration and exploitation of these deposits were reserved for the German Democratic Republic. Production of the two tantalum minerals, tantalite and microlite, was not reported, but it was estimated that all such minerals recovered were exported to the German Democratic Republic.

NONMETALS

Limestone, Lime, Cement.—The State-owned company, Cimentos de Mocambique, continued to operate lime-burning plants at Dondo and Salamanga, and cement kilns at Dondo, Matola, and Nacala. Casting of prestressed concrete sleepers (crossties) for the rehabilitated railroad line contributed to increased demand for concrete aggregate. The State Marble Co. operated a quarry near Montepuez in the southern Cabo Delgado District, about 200 kilometers northwest of the port of Nacala, that reportedly produced about 75 tons of block marble per month during the early part of the year.

Salt.—Early in May, it was announced that the operation of the Fabrica de Higien-

izacao de Sal at Matola would be headquarters for a newly established National Salt Producing Co. that would open branches in remote provinces where salt-drying enterprises had been abandoned by their preindependence owners. The first such branch was to be the Diezo project in Pemba Bay where a salt-drying pond had the capacity of extracting 5,000 tons of salt per year. New equipment to be installed at Matola would enable the export of 3,000 tons of salt, with a foreign exchange value of $270,000, to Zimbabwe and Swaziland.

MINERAL FUELS

Coal.—The Moatize coal mine was reportedly shutdown in late 1979 because of major damages to three bridges allegedly inflicted by Rhodesian forces. The resulting shutdown lasted for 3 months and was blamed for the failure to produce 550,000 tons of coal projected in the plan for 1980. Production at 408,000 tons was 142,000 tons short of the target. The country remains plagued by inadequate rail facilities from Moatize to Beira, a severe shortage of trained manpower and technical staff, and a critical lack of spare parts for its aging equipment.

Petroleum.—The GPRM State enterprise responsible for refining and for most domestic distribution of petroleum, Empress Nacional Petroles de Mozambique (Petromac), was formed by the amalgamation of two former Portuguese companies, SONAREF (refining) and SONAP (distribution), both of which were nationalized in 1977. Compensation was promised to the shareholders, but no payment had been made by late 1980. Two South African subsidiaries of U.S. companies traded locally in Mozambique as Caltex Oil S.A. (Pty.) Ltd. and Mobile Oil of Southern Africa (Pty.) Ltd. British and Dutch interests were represented jointly by BP and Shell Mocambique. "Total Oil" at Maputo was responsible only for bonded storage of petroleum in transit to the Republic of South Africa, and CALTEX and MOBIL operated out of Beira as transit agents for Malawi. There were no oil or gas exploration permits in force in Mozambique, but both ENI and Braspetro were reported to be negotiating with the GPRM.

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[1]Physical scientist, Branch of Foreign Data.

The Mineral Industry of Namibia (Territory of South-West Africa)

By Miller W. Ellis[1]

The mineral industry of Namibia provided about 50% of the country's $1,717 million[2] gross domestic product (GDP) in 1980 and established its position as the fourth largest producer of nonfuel minerals on the African Continent in terms of total value. Most of Namibia's mineral products were produced and exported by three mining companies; Tsumeb Corp. Ltd., largely controlled by United States base-metal mining companies; Consolidated Diamond Mines (Pty.) Ltd. (CDM), a major subsidiary of De Beers Consolidated Mines Ltd. of the Republic of South Africa; and Rossing Uranium Ltd. (RUL), owned 46.5% and managed by the British firm Rio Tinto-Zinc Corp. Ltd., with other South African firms and Total Compagnie Miniere et Nucleaire of France as partners.

CDM contributed about 30% of the country's GDP in 1980 and exported diamonds earned about half of its foreign exchange. CDM also generated 60% of the country's tax revenue and was its largest employer. Tsumeb was the second largest employer in the country with 6,043 employees on the payroll at yearend. About 350 people were hired late in the year to start up the Otjihase Mine, which was purchased in December. Tsumeb was not a heavy taxpayer despite its declared sales of $161.9 million. Net income declined by 35% to $18.2 million, and because of the capital expenditure of $52.6 million including the purchase of a 70% interest in the Otjihase Mine from the Johannesburg Consolidated Investment Co. Ltd. (JCI), Tsumeb paid about $12.9 million in taxes. The company's normal tax rate was increased from 35% to 40% of taxable profits during 1980, but the 5% surcharge and the 15% loan levy were abolished. RUL, as a newly producing mining venture, paid no taxes in 1980 despite its profits of $123 million and was not subject to taxation until its investment has been amortized.

All three companies continued exploration programs during 1980. CDM allowed some results of its mineral surveys to be placed on open file with the Geological Survey of South-West Africa and has applied for coal prospecting rights on both sides of the Nossob River, west from the Botswana border. Namibia's offshore areas and the northern part of the country have been leased for oil exploration. Resumption of exploration for oil in the Etosha Pan area was planned for 1982. The South-West African Oil Exploration Corp. (Pty.) Ltd. was not active in 1980.

In June 1980, the minimum starting wage for unskilled mine employees was increased by 14.3%. This was in addition to an "average minimum living level for an urban family of five" that has been established from time to time by the University of South Africa as a measure of the amount and quality of the housing, food, clothing, medicine, and social services provided free to employees.

The country's electricity supply and grid of transmission lines interconnecting its mines were improved substantially during 1980 by the South-West Africa Water and Electricity Corp. Generation of power at the recently completed Ruacana Falls hydro-

electric station near the Angolan border was restarted in January when the Kunene River gates (in Angolan territory) were forcibly jammed allowing water to flow through the diversion weir and into the power station penstocks. The station generated 240 megawatts of power, which was transmitted over a 600-kilometer transmission line to a power-switching station at Omaruru, 160 kilometers northwest of Windhoek. In April, some of the transmission line pylons were destroyed by the South-West Africa People's Organization, which interrupted the power supply. The pylons were replaced and power was restored in May, and precautions were taken to ensure against a repetition of the outage. Ruacana's capacity was subsequently able to handle most of the country's demand for power which has averaged about 140 megawatts.

The Van Eck 120-megawatt power station at Windhoek and the 45-megawatt emergency generator at Walvis Bay continued to be available as backup power sources, and a total of 100 megawatts was available from the Electricity Supply Commission's (ESCOM) power grid in the Republic of South Africa. One of the connecting links with the external grid was through the CDM installations north of the Orange River mouth. CDM's power consumption increased from 23 megawatts average half-hourly maximum demand in 1979 to 33.6 megawatts and was expected to increase further by 1982 with the commissioning of a central food preparation depot and the possible electrification of overburden stripping. CDM's 10-megawatt standby power station underwent a major overhaul in 1980 and its capacity was increased to 18 megawatts. Other power links with ESCOM were along the road north from Springbok, and along the railroad that crossed the Orange River at Upington in the Republic. An additional 100 megawatts from ESCOM's grid was expected to be available in 1982,when a new $90 million power hookup with Aggeneys in northern Cape Province was to be completed.

PRODUCTION AND TRADE

The production statistics in table 1 were compiled largely from annual reports of some of the companies operating within Namibia. Publication of separate production statistics was suspended by the South-West African Administration in 1965. Although the country's economy depends on mineral exports, specific reporting of their magnitude and value remained unavailable and were no longer included in statistics published by the Minerals Bureau of the Republic of South Africa.

Diamonds continued to be marketed through De Beers Central Selling Organization and were exported to the Republic of South Africa and overseas. RUL's uranium concentrates were exported from Walvis Bay to contract customers in Western Europe and Japan. Tsumeb's metal production was transported on the company's 640-kilometer railroad to its loading facilities at Walvis Bay for export to overseas customers. Other metal concentrate was railed to smelters and refineries in the Republic of South Africa.

Table 1.—Namibia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS[3]					
Arsenic,white[4]	5,122	2,615	2,401	2,221	1,288
Cadmium: Metal, refined	83	r88	79	81	69
Copper:					
Mine output, metal content, recoverable[5]	43,500	49,200	37,700	41,900	39,200
Metal, blister	r36,570	r53,371	45,919	42,707	40,004
Lead:					
Mine output, metal content, recoverable	46,400	41,200	38,600	46,000	47,700
Metal, refined	r39,598	r42,743	39,512	41,695	42,654
Silver: Mine output, metal content, recoverable[6] thousand troy ounces	r1,597	r1,758	1,866	2,106	2,172
Tin, mine output, metal content, recoverable	800	994	1,250	1,042	1,000
Tungsten, mine output, metal content, recoverable[e]	140	150	150	165	150
Uranium, U_3O_8 content	700	2,760	3,175	4,518	4,767
Vanadium, mine output, metal content[e]	700	750	440	--	--
Zinc, mine output, metal content[7]	41,308	38,300	36,600	23,300	31,908

See footnotes at end of table.

Table 1.—Namibia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS					
Diamond:[8]					
Gem[e] thousand carats	1,609	1,901	1,803	[r]1,570	1,482
Industrial[e] do	85	100	95	[r]83	78
Total do	1,694	2,001	1,898	1,653	1,560
Lithium minerals[9]	5,915	2,548	NA	NA	NA
Salt[e]	220,000	230,000	230,000	230,000	230,000
Sulfur, S content of pyritic concentrate	[r]3,520	[r]3,834	3,013	3,538	3,692

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 22, 1981.

[2]In addition to the commodities listed, Namibia, prior to 1967, produced bismuth concentrates, cesium ore, columbite-tantalite concentrates, gold, manganese ore, molybdenum concentrates, graphite, lime, mica, precious stones, kyanite, sillimanite, and a variety of crude construction materials (clays, stone, sand and gravel). No official statistics have been published since yearend 1966, and available information is inadequate to ascertain whether production has been continued or not, and if so, at what levels.

[3]Data are compiled from operating company reports as follows: Tsumeb Corp. Ltd. (arsenic, white and refined cadmium, mine and blister copper, mine and refined lead, mine and smelter silver, mine zinc, and pyrite concentrate); South-West Africa Co. Ltd. (SWACO) (mine lead, mine tin, mine tungsten, mine vanadium, and mine zinc); South African Iron and Steel Industrial Corp. Ltd. (ISCOR) for Imcor Zinc (Pty.) Ltd.'s Rosh Pinah Mine (mine lead and mine zinc), and for ISCOR's own Uis mine (mine tin); General Mining and Finance Corp. Ltd. for Klein Aub Koper Maatskappy Ltd.'s mine near Rehoboth (mine copper and mine silver); and Falconbridge Nickel Mines Ltd. for Oamites Mining Co. (Pty.) Ltd.'s mines (mine copper). Data from Tsumeb and Falconbridge are for calendar years; data from other companies for fiscal years ending June 30 of that stated.

[4]White arsenic equivalent of all arsenic products reported as being produced.

[5]Figures comprise reported production of Tsumeb and Oamites plus estimates for Klein Aub and Otjihase copper mine (bought by Tsumeb in December 1980).

[6]Figures comprise reported production of Tsumeb plus estimates for Oamites, Rosh Pinah, and Klein Aub.

[7]Figures comprise reported production of Tsumeb Corp, a reported figure for SWACO for 1976, and estimates for SWACO for 1977 and 1978, as well as estimates for Rosh Pinah.

[8]Total figures reported by DeBeers Consolidated Mines Ltd. in company annual reports for calendar years. Detail on gem and industrial diamonds are estimates, assuming output to be 95% gem quality.

[9]Output has not been officially reported since 1966, but presumably has continued since a number of countries record imports from "South Africa," which in total quantity considerably exceed the reported output of the Republic of South Africa and presumably include shipments from Namibia. Quantities given represent imports of the United States and the European Communities reported as originating in South Africa, but the reader is cautioned that a portion of the material may have been mined in Zimbabwe.

COMMODITY REVIEW

METALS

Copper.—Tsumeb continued to be the country's foremost producer of nonferrous metals, its leading exporter of copper, lead, and silver, and its sole producer of arsenic and cadmium. The company was managed and 29.6% owned by Newmont Mining Corp. of the United States. Another U.S. company, AMAX Inc., owned 29.6%, the British firm Selection Trust Ltd. owned 14.2%, the O'okiep Copper Co. Ltd. of South Africa owned 9.5%, and the remainder was held by other firms including the South-West Africa Co. Ltd. (SWACO)with 2.4%.

The Tsumeb Mine has continued to be the largest in the area north of the capital at Windhoek, and in 1980 it produced and milled 498,149 tons of ore, containing 3.61% copper, plus lead and zinc, from which 18,788 tons of copper concentrate containing 43.81% copper and 37.6 troy ounces of silver per ton was recovered. The company also operated the Matchless Mine, 42 kilometers south of Windhoek, which produced 126,647 tons of pyritic copper ore containing 1.82% copper and 12.83% sulfur in 1980. The Matchless mill produced 11,170 tons of concentrate which contained 19.13% copper, 33.05% sulfur, and 2.2 troy ounces of silver per ton. Tsumeb also produced 332,736 tons of 2.67% copper, 2.32% lead ore from its Kombat and Asis West Mines. The Kombat mill treated the ore which yielded 23,230 tons of copper concentrate containing 26.26% copper, plus lead, and 7.4 troy ounces of silver per ton. The Asis West Mine was also operated by a Tsumeb subsidiary, the Tsumeb Exploration Co. Ltd. (TECO), which produced 14,144 tons of ore containing 3.99% copper and 0.76% lead. This ore was milled at the Kombat concentrator and yielded 1,972 tons of concentrate containing 26.59% copper, some lead, and 4.9 troy ounces of silver per ton.

JCI expended $1.4 million for under-

ground development and exploratory drilling at its Otjihase Mine, 27 kilometers northeast of Windhoek in the first half of 1980. Tsumeb subsequently purchased a 70% share in the property and commenced mining in December to produce 4,150 tons of 1.69% copper ore from which the Otjihase mill recovered 203 tons of concentrate containing 14.03% copper. The Tsumeb copper smelter treated all of the company's copper concentrates, and produced 26,036 tons of blister copper, down 9.5% from that of 1979. The smelter also produced 12,441 tons of blister copper from other mines' concentrates treated on a toll basis, and recovered 1,527 tons of blister copper from purchased concentrates.

The Oamites Mining Co. (Pty) Ltd., jointly owned by Falconbridge Nickel Mines Ltd. of Canada (74.9%) and the International Development Corp. (IDC) of the Republic of South Africa, continued to be the country's second largest copper producer. The Oamites Mine, 55 kilometers south of Windhoek, was extracting low-grade (1.1% copper) ore by a sublevel open-stoping method coupled with a high degree of automation that allowed production cost to be maintained at a satisfactory level. The nearby Swartmodder Mine also contributed to Oamites overall production.

Lead and Zinc.—All of Tsumeb's established mines produced complex ores with a mixture of lead, zinc, and copper minerals containing other valuable constituents. The Tsumeb Mine was the country's largest lead producer and one of its two sources of zinc. The 498,149 tons of ore contained 7.13% lead and 2.26% zinc, from which the Tsumeb concentrator produced 96,421 tons of lead concentrates that contained 31.37% lead, with 8.57% copper, 6.56% zinc, and 6.6 troy ounces of silver per ton. Its zinc concentrate weighed 3,019 tons and contained 52.43% zinc, 2.93% copper, 8.06% lead, and 9.9 troy ounces of silver per ton. Ores from the Kombat and Asis West Mines also contained lead and the Kombat mill recovered 12,294 tons of lead concentrate with 36.65% lead, 17.66% copper, and 5.5% troy ounces of silver per ton on behalf of the parent company, and 45 tons of lead concentrate containing 35.12% lead, 20.04% copper, and 3.9 troy ounces of silver per ton from Asis West ore on behalf of TECO.

Tsumeb's lead smelter produced 33,455 tons of refined lead from its own concentrates, an increase of 6.6% over the 1979 output. It also produced 8,168 tons of refined lead from purchased concentrate and 1,031 tons of metal from concentrates smelted on toll for other producers. Tsumeb's complex ores also produced 1,288 tons of arsenic, down 42% from the 1979 output, and 69 tons of cadmium, 15% less than the previous year. Its silver production totaled 1.65 million troy ounces.

The country's top zinc producer was the Rosh Pinah open pit mine in the Namib Desert, 27 kilometers north of the Orange River, operated by and for Imcor Zinc (Pty.) Ltd., a subsidiary of the South African Iron and Steel Industrial Corp. Ltd. (ISCOR). Rosh Pinah Mine's capacity was 160,000 tons per month of ore to produce about 50,000 tons of 40% zinc concentrate and 15,000 tons of 45% lead concentrate per year. Both concentrates were trucked 180 kilometers to railhead at Aus, where they were railed to ISCOR's steelworks at Vanderbijlpark in the Transvaal Province of South Africa.

Kiln Products Ltd., a subsidiary of SWACO, was administered by Gold Fields of South Africa Ltd. (GFSA), and partly owned by Anglo American Corp. of South Africa Ltd. (AAC). It continued to retreat old tailings material at the Berg Aukas Mine using jigs to make a zinc-rich silicate concentrate that was treated in the Waelz Kiln with imported coke or anthracite to produce zinc metal. Consumption of coke was reduced by reclaiming unconsumed carbon from the slag dump with jigs. Production of vanadium from this former source has not been reported.

Tin and Tungsten.—Most of the country's tin production continued to be derived from ISCOR's Uis Mine near Brandberg, northeast of Swakopmund. The tin concentrate was shipped directly to the Vanderbijlpark Steel Works in the Republic of South Africa where it was smelted and used to produce electrolytic tin plate for local consumption. GFSA reported the closing of SWACO's Brandberg tin mine in mid-1980 because of an uneconomic yield.

Uranium.—The Rossing Uranium Ltd. operation, 65 kilometers east of Swakopmund, was reported to have approached its designed capacity with 4,767 tons of U_3O_8 (yellow cake) concentrate in 1980, and a profit of $123 million for its managers and part owners, Rio Tinto Zinc Corp. Ltd. of the

United Kingdom. Partners included the General Mining and Finance Corp. Ltd. (GMF) and IDC of the Republic of South Africa, Total Compagnie Miniere et Nucleaire of France, and Rio Algom Mines Ltd. of Canada.

Exploration for uranium deposits continued through 1980 including GMF at the Langer Heinrich deposit, GFSA at the Trekkopje deposit, two deposits at Tubas and Assinanis where the French ELF-Aquitaine oil company, operating as Omitaramines, and AAC were jointly interested. In all cases, it appeared that the ore grades were too low to warrant production until a more favorable political and economic climate prevails.

NONMETALS

Diamond.—Production of diamonds by CDM continued to decline slightly as total ore treated increased to 16,822,600 tons containing 9.27 carats per 100 tons. The ore consisted of marine gravels and was covered by 56,577,400 tons of barren sand and gravel overburden. The availability of the bucket wheel excavator for this work increased from 65% in 1979 to 71% in 1980. A revised bedrock cleaning bonus system was implemented throughout the operation during 1980 and productivity increased from 18.1 to 20.2 square meters per workshift. The cleaners also picked up 46,042 carats of diamond during this operation. Prospecting of new deposits continued and included treating 308,800 tons of samples of potential ore.

MINERAL FUELS

Coal.—In the early 1950's, AAC discovered coal on the north bank of the Nossob River near the Aminuis Reserve and during 1980 its affiliated company, CDM, applied for extensive prospecting grants on both sides of the Nossob River in the Aranos area. The results of diamond drilling indicated extensive coal deposits to depths of 300 meters, and that artesian water might be tapped underlying the coalbeds. Exploration for coal was reported to have continued in the Etosha Pan area and along the Kaokoveld coast.

Petroleum.—The Etosha Petroleum Co., owned by Briland Mines Ltd., has held an oil and gas exploration concession near the Angolan boundary in northern Namibia for a number of years and in February 1980 signed a letter of intent giving Superior Oil Co. a contract to execute test drilling operations over a portion of Etosha's area. Financing was reportedly arranged through Allen & Co. Inc. of New York. There were no changes in concession boundaries during the year. The Southern Oil Exploration Corp. (South-West Africa) (Pty.) Ltd. continued to be responsible for granting oil exploration concessions, and its parent company, Southern Oil Exploration Corp. (Pty.) Ltd., continued to hold offshore concessions south of Walvis Bay, but no drilling was reported in 1980.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from South African Rand (R) to U.S. dollars at the rate of R1 = US$1.189 for 1979 and R1 = US$1.2854 for 1980.

The Mineral Industry of the Netherlands

By William F. Keyes[1]

The Netherlands economy during 1980 paused at a high level. Unemployment was relatively high (by the Netherlands standards) and increasing slowly. The severe rise in oil prices in 1979 was adversely affecting the exposed economy, which exports 40% of its national product and imports a similar amount. The oil price increase was estimated to have increased the balance of payments current account deficit from about $2 billion[2] in 1979 to $2.5 billion to $3 billion in 1980. However, with the rise in the export price of Netherlands natural gas being negotiated in 1980, the deficit was optimistically estimated at only $500 million in 1981. Domestic roots of this stagnation were also to be found in the costs of high wages and social amenities brought about largely by the benefits of natural gas production.

The Netherlands is a major producer and the world's largest exporter of natural gas. Nevertheless, it was disappointing to the Netherlands authorities that a large contract to import liquefied natural gas from Algeria, saving domestic supplies, was canceled by the Algerian Government. The major Hoogovens steel plant, representing most of the Netherlands industry, was also in difficulties, and there was talk of dissociating it from its even more distressed sister plant in Dortmund, Federal Republic of Germany.

PRODUCTION

The index of mineral production rose from 124 to 133 during 1980 owing to a rise in the natural gas figure from 125 to 134. Other mineral production was steady at 99 at the end of 1980. The general industry figure rose from 113 to 118 during the period. The figures were calculated based on 1975=100. Production of minerals in recent years is given in table 1.

Table 1.—Netherlands: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal:					
Primary	255,504	241,269	261,164	257,719	262,150
Secondary	38,533	41,591	43,991	46,643	53,437
Cadmium metal	397	302	402	416	455
Iron and steel:					
Sintered ore (from imported ore) thousand tons	2,582	2,709	3,012	2,929	2,735
Pig iron including blast furnace ferroalloys do.	4,265	3,922	4,613	4,814	4,328
Crude steel do.	5,189	4,927	5,590	5,806	5,272
Semimanufactures do.	4,530	4,251	4,732	4,993	4,491

See footnotes at end of table.

Table 1.—Netherlands: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS —Continued					
Lead metal:[3]					
Smelter[e]	r5,000	r3,300	r500	r6,800	6,000
Refined:					
Primary	21,890	21,132	18,172	16,432	13,902
Secondary	14,800	12,700	13,700	14,700	13,900
Total	36,690	33,832	31,872	31,132	27,802
Tin metal:[e]					
Primary	2,000	2,100	1,600	1,445	1,370
Secondary	180	180	180	180	180
Zinc metal, primary	140,807	109,398	135,399	153,982	169,539
NONMETALS					
Cement, hydraulic thousand tons	3,481	3,895	3,918	3,701	3,745
Nitrogen: N content of ammonia do	1,980	2,140	2,148	2,036	1,991
Salt, all types do	3,026	3,111	2,939	3,951	3,464
Sand, industrial do	24,400	25,600	23,500	NA	24,600
Sodium compounds:					
Sodium carbonate do	271	276	280	e420	e420
Sodium sulfate, synthetic do	50	50	50	50	50
Sulfur:					
Elemental byproduct:					
Of metallurgy[e] do	85	64	60	60	60
Of petroleum do	r e170	r e155	r e150	r e160	138
Total do	r255	r219	210	220	198
Sulfuric acid, 100% H_2SO_4 do	1,402	1,572	1,680	1,744	1,726
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	90,000	90,700	86,800	93,000	95,300
Coke thousand tons	2,813	2,501	2,401	2,528	2,455
Gas:					
Manufactured, all types[4] million cubic feet	259,403	218,942	264,531	299,154	e280,000
Natural:					
Gross do	3,436,171	3,421,940	3,133,456	3,407,425	3,219,023
Marketed do	NA	NA	NA	3,291,947	3,211,218
Natural gas liquids thousand 42-gallon barrels	1,760	1,836	1,003	2,253	3,162
Peat[e] thousand tons	400	400	400	400	400
Petroleum:					
Crude thousand 42-gallon barrels	9,345	9,420	9,556	8,970	8,724
Refinery products:					
Gasoline:					
Aviation do	1,228	1,095	1,157	907	774
Motor do	59,118	54,460	60,588	63,248	61,812
Jet fuel do	23,888	24,320	21,728	28,040	26,408
Kerosine do	5,193	4,487	3,860	4,270	3,371
Distillate fuel oil do	134,496	133,974	139,726	148,081	127,559
Residual fuel oil do	144,395	131,868	124,475	121,319	99,707
Lubricants do	6,601	3,892	4,200	3,955	3,955
Bitumen do	6,260	5,660	} 53,363	{ 5,563	5,327
Liquefied petroleum gas do	12,203	11,832		13,897	10,730
Other do	71,409	57,574		44,288	31,509
Refinery fuel and losses do	25,592	18,943	17,807	29,864	24,971
Total do	490,383	448,105	426,904	463,432	396,123

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 10, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, stone, and gravel) presumably is also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]In previous editions, refined lead production, both primary and secondary, was erroneously captioned as smelter lead production, and actual smelter output was unreported; these errors have been corrected in this edition.

[4]Coke oven and blast furnace gas only.

TRADE

Total Netherlands exports increased 19.9% in value during the period January to August, compared with that of a year earlier. There was a particular demand for Netherlands petroleum and petrochemical products before the delayed effect of higher crude oil prices was fully passed along. The minerals trade of the Netherlands for 1978 and 1979, latest years available, is reported in tables 2 and 3.

Table 2.—Netherlands: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Ash and residue	6,089	7,847	--	West Germany 4,750; France 1,604.
Bauxite	3,295	26,323	NA	West Germany 23,864; Belgium-Luxembourg 971.
Oxide and hydroxide	39,519	59,486	403	West Germany 30,307; Italy 6,761; France 5,263.
Metal including alloys:				
Scrap	61,994	67,297	NA	West Germany 48,752; France 10,542; Italy 4,314.
Unwrought	294,443	359,399	75	Belgium-Luxembourg 155,492; West Germany 81,610; France 79,444.
Semimanufactures	80,433	96,080	66	West Germany 41,477; Belgium-Luxembourg 16,124; France 11,601.
Antimony:				
Oxide	407	474	NA	West Germany 394; United Kingdom 23.
Metal including alloys, all forms	39	136	NA	West Germany 47; Italy 35; United Kingdom 35.
Arsenic oxide and acid	r2	81	NA	West Germany 70.
Bismuth metal including alloys, all forms	66	27	NA	France 5; West Germany 5; India 5.
Cadmium metal including alloys, all forms	373	528	147	France 164; West Germany 94; United Kingdom 63.
Chromium:				
Chromite	15,150	14,417	NA	France 6,244; West Germany 5,903; Switzerland 1,062.
Oxide and hydroxide	361	183	NA	United Kingdom 60; Italy 35; Belgium-Luxembourg 22.
Cobalt:				
Oxide and hydroxide	62	78	NA	West Germany 25; United Kingdom 18; Belgium-Luxembourg 13.
Metal including alloys, all forms	100	254	14	United Kingdom 110; West Germany 56; Japan 27.
Columbium and tantalum metals including alloys, all forms	8	8	8	
Copper:				
Ore and concentrate	16	9	--	NA.
Oxide	28	35	NA	United Kingdom 20.
Ash and residue	4,428	5,434	NA	West Germany 3,383; Belgium-Luxembourg 1,403.
Sulfate	1,769	612	NA	United Kingdom 310; Belgium-Luxembourg 214.
Metal including alloys:				
Scrap	41,509	56,006	--	West Germany 29,628; Belgium-Luxembourg 17,587; Italy 5,600.
Unwrought	r4,589	5,327	23	West Germany 1,548; Belgium-Luxembourg 1,462; Italy 1,157.
Semimanufactures	53,456	55,112	13,158	West Germany 10,968; France 6,534; United Kingdom 5,994.
Germanium metal including alloys, all forms	1	--		
Gold metal including alloys, unworked and partly worked troy ounces	850,375	948,167	582	France 389,182; Switzerland 365,234; Israel 67,701.
Iron and steel:				
Ore and concentrate, except roasted pyrite	11,671	119,490	NA	West Germany 112,469; France 2,308; Italy 1,805.
Roasted pyrite	154	76	NA	NA.
Metal:				
Scrap thousand tons	1,190	1,241	NA	West Germany 623; Belgium-Luxembourg 282; Spain 173.
Pig iron, ferroalloys, similar materials	16,637	32,453	NA	West Germany 25,972; Belgium-Luxembourg 1,856; Italy 1,078.
Steel, primary forms thousand tons	1,708	1,979	303	West Germany 497; Belgium-Luxembourg 452; Norway 141.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	537,501	431,883	1,472	Belgium-Luxembourg 125,153; West Germany 78,613; United Kingdom 26,320.
Universals, plates, sheets thousand tons	1,625	1,803	208	United Kingdom 313; West Germany 275; Belgium-Luxembourg 200.
Hoop and strip	119,052	134,493	1,143	West Germany 74,627; Switzerland 25,430; France 7,866.
Rails and accessories	39,702	28,381	NA	West Germany 16,393; Italy 9,677.
Wire	54,665	40,142	166	West Germany 12,871; Belgium-Luxembourg 9,979; France 7,480.
Tubes, pipes, fittings	553,138	438,109	3,713	West Germany 129,529; Belgium-Luxembourg 60,586; Saudi Arabia 47,093.
Castings and forgings, rough	12,450	24,680	NA	Belgium-Luxembourg 19,650; West Germany 3,681.
Lead:				
Ash and residue	3,945	5,328	NA	Belgium-Luxembourg 4,394; West Germany 369; Spain 215.
Oxide	3,841	5,153	NA	Italy 3,923; West Germany 742; Iran 150.
Metal including alloys:				
Scrap	32,825	35,362	--	West Germany 20,477; Belgium-Luxembourg 7,646; France 5,555.
Unwrought	21,722	18,707	448	West Germany 11,466; Belgium-Luxembourg 1,552; Italy 1,418.
Semimanufactures	r2,261	1,738	NA	Norway 598; Belgium-Luxembourg 587; United Kingdom 253.
Magnesium metal including alloys:				
Scrap	1,687	1,304	589	West Germany 319; Italy 209; United Kingdom 142.
Unwrought and semimanufactures	r4,628	6,002	NA	West Germany 3,056; United Kingdom 1,427; Italy 921.
Manganese:				
Ore and concentrate	37,452	37,422	NA	West Germany 10,389; France 4,051; Belgium-Luxembourg 3,659.
Oxide	8	10	NA	NA.
Metal including alloys, all forms	2,768	2,083	NA	West Germany 1,782; France 151.
Mercury 76-pound flasks	1,993	2,930	NA	West Germany 1,770; United Kingdom 580.
Molybdenum:				
Oxide	1,621	1,445	45	Austria 1,045; West Germany 150; United Kingdom 105.
Metal including alloys, all forms	153	185	8	Belgium-Luxembourg 127; France 31.
Nickel:				
Matte, speiss, similar materials	2,568	4,034	NA	West Germany 2,142; United Kingdom 367; France 357.
Oxide and hydroxide	273	488	NA	Italy 139; West Germany 82; United Kingdom 73.
Metal including alloys:				
Scrap	1,845	2,071	75	West Germany 875; United Kingdom 372; Belgium-Luxembourg 167.
Unwrought	3,246	3,816	6	Italy 2,478; West Germany 727; France 163.
Semimanufactures	338	525	NA	West Germany 361; United Kingdom 30.
Platinum-group metals, all forms troy ounces	37,843	49,931	4,000	Brazil 11,001; West Germany 7,965; Switzerland 6,878.
Selenium, elemental	6	3	NA	NA.
Silver metal including alloys, all forms thousand troy ounces	r8,927	10,100	868	Switzerland 2,867; Belgium-Luxembourg 1,821; West Germany 1,648.
Tellurium, elemental, and arsenic	17	44	NA	France 40; West Germany 2.
Tin:				
Oxide	(1)	8	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap	549	513	NA	United Kingdom 301; West Germany 86; Belgium-Luxembourg 52.
Unwrought	1,274	1,275	NA	West Germany 625; Belgium-Luxembourg 314; United Kingdom 217.
Semimanufactures	691	738	4	West Germany 445; Belgium-Luxembourg 80; France 54.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	940	2,599	NA	Norway 1,079; West Germany 910; United Kingdom 347.
Oxide	10,228	1,089	NA	West Germany 143; France 138; United Kingdom 123.
Metal including alloys, all forms	135	114	3	United Kingdom 48; Italy 25; West Germany 21.
Tungsten:				
Ore and concentrate	1,260	1,161	31	U.S.S.R. 757; West Germany 83; Czechoslovakia 72.
Metal including alloys, all forms	243	202	2	Belgium-Luxembourg 118; West Germany 31.
Zinc:				
Ash and residue	12,887	12,359	NA	Belgium-Luxembourg 5,073; West Germany 4,326; France 1,923.
Ore and concentrate	3,200	11,501	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap	6,352	4,419	NA	West Germany 1,447; France 1,350; Belgium-Luxembourg 1,055.
Dust (blue powder)	2,821	3,457	NA	NA.
Unwrought	123,205	136,807	1,241	United Kingdom 41,776; West Germany 33,809; France 13,550.
Semimanufactures	5,615	2,554	NA	West Germany 1,754; Belgium-Luxembourg 232; France 221.
Zirconium ore and concentrate	r859	270	NA	NA.
Other metals, n.e.s.:				
Ores and concentrates	r24,249	23,363	--	Italy 4,595; United Kingdom 4,473; Austria 4,033.
Ash and residue containing nonferrous metals	9,663	18,295	64	West Germany 6,873; Belgium-Luxembourg 6,520; Austria 2,101.
Oxides, hydroxides, peroxides	r32	46	NA	West Germany 31; Venezuela 5.
Base metals including alloys, all forms	r60	38	NA	United Kingdom 21; West Germany 6; Belgium-Luxembourg 5.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, natural corundum, etc	7,835	19,680	75	United Kingdom 13,004; Pakistan 926; Thailand 886.
Dust and powder of precious and semiprecious stones, including diamond kilograms	205	152	11	West Germany 34; Japan 24; France 21.
Grinding and polishing stones	3,357	3,543	20	West Germany 841; United Kingdom 769; Belgium-Luxembourg 498.
Artificial corundum	445	306	NA	Australia 216.
Asbestos	393	56	NA	NA.
Barium materials:				
Barite and witherite	94,774	77,458	NA	United Kingdom 48,300; Norway 13,388; West Germany 11,980.
Barium oxide	63	338	NA	West Germany 309; Belgium-Luxembourg 9.
Borates, crude, natural	338,960	369,997	NA	West Germany 73,584; France 69,539; United Kingdom 60,117.
Cement	412,319	370,797	NA	West Germany 192,519; Belgium-Luxembourg 87,841; Nigeria 61,468.
Chalk	29,886	25,753	NA	Belgium-Luxembourg 24,525; United Arab Emirates 626.
Clays and clay products including all refractory brick:				
Crude clays:				
Bentonite	23,839	26,462	NA	Oman 7,048; Belgium-Luxembourg 5,230; France 3,910.
Fuller's earth, dinos, chamotte	4,171	3,270	NA	West Germany 1,932; Belgium-Luxembourg 892; Nigeria 200.
Kaolin	84,085	88,931	NA	Belgium-Luxembourg 75,712; West Germany 9,847.
Kyanite and sillimanite	261	519	NA	France 265.
Other	104,778	85,636	NA	West Germany 60,428; Belgium-Luxembourg 17,569.
Products:				
Refractory including nonclay bricks	24,979	34,975	NA	West Germany 13,324; Belgium-Luxembourg 4,166.
Nonrefractory	756,645	833,476	NA	West Germany 607,967; Belgium-Luxembourg 171,373.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond, excluding dust and powder:				
Worked:				
Gem carats	599,552	122,300	31,765	Belgium-Luxembourg 27,235; West Germany 12,624; Israel 12,527.
Industrial do	6,753	11,468	7,775	West Germany 874; Belgium-Luxembourg 839; Japan 780.
Unworked:				
Gem do	249,466	21,439	748	Belgium-Luxembourg 13,077; Israel 2,657; Malta 2,603.
Industrial do	1,065,200	833,999	253,544	Belgium-Luxembourg 162,507; Switzerland 70,058.
Unsorted do	1,084,830	295,223	40,936	Switzerland 100,824; Belgium-Luxembourg 78,527.
Diatomite and other infusorial earths	520	559	NA	Switzerland 192; Belgium-Luxembourg 189.
Feldspar, fluorspar, leucite	6,441	7,863	NA	Belgium-Luxembourg 3,348; West Germany 2,401.
Fertilizer materials:				
Crude:				
Phosphatic	66,605	71,426	NA	West Germany 68,590.
Other including mixed	r78,572	77,507	NA	Belgium-Luxembourg 61,573; West Germany 14,476.
Manufactured:				
Nitrogenous thousand tons	3,089	3,137	367	India 591; Brazil 520; France 356.
Phosphatic including Thomas slag	236,734	326,500	--	France 119,984; West Germany 86,524.
Potassic	r827	3,346	--	Nigeria 2,183.
Other including mixed thousand tons	953	1,077	NA	France 398; United Kingdom 161; West Germany 140.
Ammonia	698,053	540,642	NA	Belgium-Luxembourg 340,692; France 54,622; United Kingdom 53,006.
Graphite, natural	r593	644	NA	West Germany 569; Belgium-Luxembourg 54.
Gypsum and plasters	2,366	3,475	NA	Belgium-Luxembourg 968; United Kingdom 875.
Lime	4,711	4,940	NA	West Germany 3,023; Saudi Arabia 1,223.
Magnesium materials:				
Magnesite	33,554	34,376	209	West Germany 16,261; France 4,392; Belgium-Luxembourg 3,662.
Oxide	13	13	NA	NA.
Mica, all forms	r716	1,233	NA	Oman 588; West Germany 161; Brunei 132.
Pigments, mineral, including processed iron oxide	4,648	6,567	1,484	West Germany 2,244; France 1,119.
Precious and semiprecious stones, except diamond, natural and synthetic, worked and unworked kilograms	4,793	1,480	NA	West Germany 261; Belgium-Luxembourg 32.
Salt thousand tons	1,891	2,475	NA	Belgium-Luxembourg 693; West Germany 561; Sweden 435.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	97,749	157,193	2,008	China, mainland 61,288; U.S.S.R. 16,336; Nigeria 13,158.
Caustic potash	13,370	109,333	NA	Saudi Arabia 74,925.
Soda ash	132,188	151,905	NA	West Germany 19,497; Denmark 19,361; Belgium-Luxembourg 8,917.
Stone, sand and gravel:				
Dimension stone:				
Unworked and partly worked	4,318	5,138	NA	West Germany 2,540; Belgium-Luxembourg 804.
Worked	11,984	9,579	NA	Belgium-Luxembourg 5,410; West Germany 3,814.
Dolomite	10,463	10,568	NA	West Germany 8,082; Belgium-Luxembourg 1,706.
Gravel and crushed stone thousand tons	3,226	4,493	NA	Belgium-Luxembourg 4,168; West Germany 318.
Limestone, excluding dimension	23	119	NA	NA.
Quartz and quartzite	11,395	13,169	NA	West Germany 10,076; Belgium-Luxembourg 1,475.
Sand, excluding metal-bearing thousand tons	8,767	9,304	NA	Belgium-Luxembourg 8,823; West Germany 340.
Strontium material, oxide	2	5	--	NA.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sulfur:				
Elemental	r9,705	11,015	--	Belgium-Luxembourg 8,681; West Germany 2,126.
Sulfuric acid, oleum	156,981	160,579	938	Belgium-Luxembourg 113,741; Spain 16,381.
Talc and steatite	3,674	4,066	NA	West Germany 1,002; Italy 941; Belgium-Luxembourg 850.
Other nonmetals, n.e.s.:				
Crude	228,367	263,859	54	Belgium-Luxembourg 85,415; France 80,223; West Germany 79,462.
Slag, dross, similar waste, not metal-bearing:				
From iron and steel manufacture	r39,401	137,543	NA	West Germany 93,433; Belgium-Luxembourg 41,834.
Other	77,824	131,103	108	Belgium-Luxembourg 61,279.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals[2]	14,125	17,836	NA	Belgium-Luxembourg 12,234; West Germany 4,003.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	51	7	NA	NA.
Carbon black	72,555	84,091	12	France 34,097; West Germany 18,192.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	485	1,032	NA	Belgium-Luxembourg 459; West Germany 409.
Briquets of anthracite and bituminous coal	3,376	9,862	--	Belgium-Luxembourg 7,596; Switzerland 2,266.
Lignite and lignite briquets	1,452	1,259	--	Belgium-Luxembourg 1,203.
Coke and semicoke	731,593	739,373	15,412	Belgium-Luxembourg 256,788; West Germany 204,192; France 120,705.
Gas, hydrocarbon:				
Manufactured	220,055	235,346	1,064	Belgium-Luxembourg 147,912; West Germany 48,218.
Natural million cubic feet	r1,840,110	1,990,439	--	West Germany 908,514; France 423,044; Belgium-Luxembourg 382,015.
Hydrogen, helium, rare gases	24,225	28,371	NA	West Germany 13,558; Belgium-Luxembourg 7,164; France 3,097.
Peat including briquets and litter	123,689	112,425	NA	Belgium-Luxembourg 54,029; West Germany 27,825; France 23,762.
Petroleum and refinery products:				
Crude 42-gallon barrels	20,189	104,878	--	Belgium-Luxembourg 86,570; West Germany 16,801.
Refinery products:[3]				
Gasoline thousand 42-gallon barrels	r69,911	84,115	600	West Germany 44,363; United Kingdom 10,269; Belgium-Luxembourg 6,865.
Kerosine do	r19,660	24,626	41	West Germany 10,981; United Kingdom 2,722; Denmark 2,661.
Distillate fuel oil do	r101,939	107,759	581	West Germany 61,246; Belgium-Luxembourg 12,330; Denmark 6,367.
Residual fuel oil do	r106,265	99,956	364	Belgium-Luxembourg 13,062; United Kingdom 12,734; West Germany 10,126.
Lubricants do	r4,116	4,357	229	Belgium-Luxembourg 954; United Kingdom 422; West Germany 271.
Other:				
Liquefied petroleum gas do	3,048	3,363	58	Belgium-Luxembourg 1,934; West Germany 518; Portugal 290.
Mineral jelly and wax do	740	605	6	West Germany 204; United Kingdom 188; France 41.
Petroleum coke, bitumen, other residues do	2,439	2,482	38	West Germany 666; Denmark 532; Norway 430.

See footnotes at end of table.

Table 2.—Netherlands: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products —Continued				
Refinery products:[3] —Continued				
Other —Continued				
Bituminous mixtures thousand 42-gallon barrels	443	420	--	West Germany 185; Sweden 80; Belgium-Luxembourg 23.
Unspecified ------do----	r461	559	--	West Germany 160; Belgium-Luxembourg 132; Sweden 67.
Total ------do----	309,022	328,242		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals -----	543,669	666,916	NA	West Germany 392,262; United Kingdom 126,982; Italy 53,083.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]Excludes quantities valued at $8,227,019 in 1978 and $7,695,618 in 1979.
[3]Includes bunkers.

Table 3.—Netherlands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	151,521	193,695	NA	Greece 186,598; Guyana 3,940; China, mainland 1,987.
Alumina	r564,437	587,570	638	Greece 223,844; Suriname 221,595; France 93,835.
Metal including alloys:				
Scrap	30,515	33,468	4,114	West Germany 15,210; Belgium-Luxembourg 5,009; United Kingdom 3,281.
Unwrought	145,508	167,331	733	Norway 94,623; West Germany 40,255; United Kingdom 12,412.
Semimanufactures	93,683	107,368	4,702	West Germany 40,946; Belgium-Luxembourg 23,304; France 12,745.
Antimony:				
Oxide	1,059	1,141	NA	Bolivia 362; United Kingdom 259; Belgium-Luxembourg 257.
Metal including alloys, all forms	126	132	NA	China, mainland 73; Spain 35; Belgium-Luxembourg 15.
Arsenic oxide and acid	r318	153	NA	Belgium-Luxembourg 56; United Kingdom 37; France 34.
Beryllium metal including alloys, all forms	3	2	NA	NA.
Bismuth metal including alloys, all forms	52	54	8	France 21; Belgium-Luxembourg 6; West Germany 6.
Cadmium metal including alloys, all forms	55	85	--	Japan 36; Finland 20; Algeria 18.
Chromium:				
Chromite	6,398	6,866	--	Republic of South Africa 6,501; Finland 264.
Oxide and hydroxide	784	888	17	West Germany 685; U.S.S.R. 135.
Metal including alloys, all forms	81	59	NA	France 30; Japan 22.
Cobalt:				
Oxide and hydroxide	387	286	70	Belgium-Luxembourg 159; United Kingdom 45.
Metal including alloys, all forms	78	194	3	Sweden 117; West Germany 25; Belgium-Luxembourg 23.
Columbium and tantalum including alloys, all forms	3	1	(1)	Mainly from Austria.
Copper:				
Ore and concentrate	64	68	--	All from Australia.
Oxide and hydroxide	884	1,103	--	West Germany 603; Italy 242; Norway 121.
Sulfate	4,603	4,285	NA	Belgium-Luxembourg 1,982; France 1,477; U.S.S.R. 285.

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Copper —Continued				
Metal including alloys:				
Scrap	r16,485	21,139	320	West Germany 6,899; Belgium-Luxembourg 4,680; France 3,665.
Unwrought	r28,060	31,166	1,186	West Germany 4,112; Poland 3,944; Japan 2,678.
Semimanufactures	91,628	103,781	1,417	West Germany 42,119; Belgium-Luxembourg 37,300; France 9,451.
Gold:				
Waste and sweepings ——value	$371,762	$821,307	--	Denmark $552,086; United Kingdom $236,158; France $32,537.
Metal including alloys, unworked or partly worked thousand troy ounces	1,148	1,086	422	Republic of South Africa 264; United Kingdom 192; France 101.
Iron and steel:				
Ore and concentrate, except roasted pyrite ——thousand tons	5,578	7,431	--	Brazil 2,391; Sweden 1,711; Liberia 913.
Roasted pyrite	7	25	NA	NA.
Metal:				
Scrap	166,359	197,088	548	West Germany 51,094; Belgium-Luxembourg 29,566; United Kingdom 22,364.
Pig iron, spiegeleisen, sponge iron, powder, shot	50,805	75,215	NA	Brazil 24,417; West Germany 15,381; Belgium-Luxembourg 10,396.
Ferroalloys	r48,781	43,674	422	Norway 20,228; France 10,749; West Germany 6,286.
Steel, primary forms	292,384	367,253	NA	Norway 152,629; West Germany 99,786; Spain 41,686.
Semimanufactures:				
Bars, rods, angles, shapes, sections ——thousand tons	1,332	1,196	570	Belgium-Luxembourg 467; West Germany 403; France 116.
Universals, plates, sheets do	1,024	1,016	2	Belgium-Luxembourg 408; West Germany 379; France 54.
Hoop and strip	193,307	187,099	416	West Germany 121,792; Belgium-Luxembourg 48,084.
Rails and accessories	45,660	51,735	NA	West Germany 30,501; France 19,995.
Wire	107,642	83,089	116	Belgium-Luxembourg 44,002; West Germany 28,396; France 6,473.
Tubes, pipes, fittings	749,007	607,888	1,074	West Germany 344,001; France 108,351; Belgium-Luxembourg 49,844.
Castings and forgings, rough	18,652	19,011	--	West Germany 10,231; Belgium-Luxembourg 6,587.
Lead:				
Oxide	8,513	8,055	25	West Germany 5,506; Belgium-Luxembourg 2,456.
Ash and residue	3,157	4,676	130	West Germany 2,743; United Kingdom 1,066.
Metal including alloys:				
Scrap	10,882	10,022	81	West Germany 7,103; Belgium-Luxembourg 1,426.
Unwrought	59,918	56,073	46	Belgium-Luxembourg 16,385; United Kingdom 11,764; Australia 11,462.
Semimanufactures	4,921	4,728	5	Belgium-Luxembourg 3,359; West Germany 500; France 470.
Magnesium metal including alloys:				
Scrap	1,188	875	NA	West Germany 545; Belgium-Luxembourg 128; France 92.
Unwrought	5,287	6,858	6,260	France 403; Norway 153.
Semimanufactures	149	272	13	West Germany 194; United Kingdom 19; Switzerland 15.
Manganese:				
Ore and concentrate	73,223	89,268	NA	Australia 3,910; France 1,195.
Oxide	1,153	1,075	72	Belgium-Luxembourg 881.
Metal including alloys, all forms	2,388	2,090	44	Republic of South Africa 2,016.
Mercury ——76-pound flasks	2,466	3,481	464	Spain 1,624; France 406.
Molybdenum:				
Oxide	60	64	59	United Kingdom 5.
Metal including alloys, all forms	153	235	6	West Germany 83; Belgium-Luxembourg 73; United Kingdom 27.

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Nickel:				
Oxide and hydroxide	887	725	34	Canada 251; Cuba 207; Australia 137.
Matte, speiss, similar materials	3,224	4,267	23	Cuba 3,822; Hungary 129; Canada 124.
Metal including alloys:				
Scrap	728	875	58	United Kingdom 255; France 207; West Germany 199.
Unwrought	4,054	5,078	54	Republic of South Africa 2,946; United Kingdom 702; West Germany 427.
Semimanufactures	1,097	1,951	213	United Kingdom 659; West Germany 583; Australia 306.
Platinum-group metals including alloys, unworked or partly worked troy ounces	61,335	64,447	4,342	U.S.S.R. 10,304; United Kingdom 9,832; France 9,414.
Silver metal including alloys, all forms thousand troy ounces	r8,100	4,703	25	West Germany 1,563; France 1,453; United Kingdom 810.
Tellurium, elemental, and arsenic	33	63	--	Mainly from Sweden.
Tin:				
Ore and concentrate	2,820	3,437	--	Bolivia 1,437; Republic of South Africa 828; Peru 642.
Oxide	r71	86	NA	United Kingdom 61; West Germany 16.
Metal including alloys:				
Scrap	971	470	44	France 225; West Germany 130.
Unwrought	5,430	5,539	168	Thailand 1,085; China, mainland 805; Malaysia 804.
Semimanufactures	147	138	NA	West Germany 68; Belgium-Luxembourg 35; Denmark 20.
Titanium:				
Ore and concentrate	1,346	4,257	NA	Australia 2,876; West Germany 1,313.
Oxide	8,627	9,040	771	West Germany 4,510; Italy 1,234; United Kingdom 702.
Metal including alloys, all forms	240	260	106	West Germany 79; Sweden 18; Belgium-Luxembourg 15.
Tungsten:				
Ore and concentrate	1,699	99	NA	Mainly from Portugal.
Oxide	4	1	--	NA.
Metal including alloys, all forms	205	123	(1)	Belgium-Luxembourg 71; United Kingdom 30.
Vanadium oxide, hydroxide, peroxide	8	8	NA	West Germany 7.
Zinc:				
Ore and concentrate	307,817	340,492	--	Canada 124,848; Ireland 55,512; Peru 41,593.
Oxide and peroxide	4,540	3,774	14	United Kingdom 1,252; West Germany 1,080; France 742.
Matte	255	192	--	France 119; West Germany 56.
Ash and residue	10,509	13,323	NA	West Germany 12,552; Cuba 253; Australia 152.
Metal including alloys:				
Scrap	7,191	9,447	NA	West Germany 6,693; Belgium-Luxembourg 2,039.
Dust (blue powder)	2,918	2,327	NA	West Germany 1,125; Belgium-Luxembourg 1,030.
Unwrought	22,226	22,699	NA	Belgium-Luxembourg 8,716; West Germany 7,592; Algeria 1,711.
Semimanufactures	r4,773	4,710	--	West Germany 2,885; Belgium-Luxembourg 1,540; France 220.
Zirconium:				
Ore and concentrate	230	214	NA	Australia 130.
Oxide[2]	75	85	19	West Germany 44; United Kingdom 19.
Other metals, n.e.s.:				
Ores and concentrates of nonferrous metals	r27,644	27,944	26,436	Chile 1,298; West Germany 97.
Ash and residue containing nonferrous metals	r86,266	61,698	303	Canada 37,357; Belgium-Luxembourg 12,293.
Metals:				
Metalloids:				
Phosphorus	105	143	NA	West Germany 104; United Kingdom 38.
Selenium	12	10	4	United Kingdom 2; Japan 2.
Silicon	4,066	6,428	--	Republic of South Africa 3,247; France 1,674; Spain 600.
Alkali, alkaline-earth, rare-earth metals	76	95	(1)	West Germany 72; U.S.S.R. 12.
Base metals including alloys, all forms	r18	61	2	West Germany 41.

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, natural corundum, etc	1,625,563	394,378	177	West Germany 367,615; Greece 18,316.
Dust and powder of precious and semiprecious stones kilograms	219	208	NA	Ireland 77; Belgium-Luxembourg 57; Switzerland 39.
Grinding and polishing wheels and stones	2,628	2,825	121	West Germany 1,225; Austria 415; United Kingdom 343.
Artificial corundum	5,893	6,057	445	West Germany 4,246; Belgium-Luxembourg 470; France 277.
Asbestos	41,357	28,235	510	Canada 20,748; Italy 3,804; West Germany 1,597.
Barium materials:				
Barite and witherite	124,608	201,894	NA	China, mainland 76,351; Chile 29,855; Morocco 27,943.
Oxide, hydroxide, peroxide	554	409	NA	West Germany 196; U.S.S.R. 194.
Boron materials:				
Crude natural borates	397,570	383,922	372,917	Belgium-Luxembourg 6,574; Turkey 4,325.
Oxide and acid	2,757	2,473	722	France 1,032; Belgium-Luxembourg 514.
Cement thousand tons	3,213	3,268	NA	Belgium-Luxembourg 1,668; West Germany 1,573.
Chalk	78,602	67,613	NA	France 41,613; Belgium-Luxembourg 13,142; West Germany 11,079.
Clays and clay products including all refractory brick:				
Crude clays:				
Bentonite	54,913	62,633	16,196	Greece 38,524; West Germany 6,505.
Fuller's earth, dinos, chamotte	33,393	36,479	3,096	West Germany 22,023; France 5,566; United Kingdom 3,290.
Kaolin	393,188	438,693	52,252	United Kingdom 203,403; West Germany 125,229; Czechoslovakia 20,244.
Kyanite and sillimanite	2,143	1,464	NA	Republic of South Africa 1,052; West Germany 278.
Other	r784,814	774,769	11,259	West Germany 738,585; France 8,236; Senegal 5,033.
Products:				
Refractory including nonclay brick	53,280	60,463	616	West Germany 35,020; United Kingdom 12,639.
Nonrefractory	561,658	367,879	--	West Germany 150,944; Belgium-Luxembourg 90,102; Italy 72,887.
Cryolite and chiolite	247	314	--	All from Denmark.
Diamonds:				
Worked:				
Gem carats	1,264,874	141,479	8,500	Israel 64,242; Belgium-Luxembourg 27,009; India 14,053.
Industrial do	2,176	21,669	NA	Belgium-Luxembourg 18,691.
Unworked:				
Gem do	623,175	63,770	3,485	Gambia 13,000; Congo 7,200; Senegal 6,500.
Industrial do	1,242,902	855,816	71,729	United Kingdom 223,715; Ireland 214,071; Belgium-Luxembourg 164,019.
Unsorted do	1,951,178	557,676	10,827	France 185,708; India 70,206; United Kingdom 60,536.
Diatomite and other infusorial earth	16,241	17,460	2,595	Denmark 10,716; West Germany 2,451; France 1,028.
Feldspar, fluorspar, leucite	65,672	63,086	NA	Norway 30,246; Canada 9,399; Belgium-Luxembourg 8,054.
Fertilizer materials:				
Crude:				
Nitrogenous	21,076	23,019	--	Chile 22,710.
Phosphatic thousand tons	2,208	2,451	485	Togo 725.
Potassic	3,993	8,130	--	West Germany 7,902.
Other including mixed	73,245	86,578	--	West Germany 76,115; Belgium-Luxembourg 7,520; France 2,326.

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Manufactured:				
Nitrogenous	330,747	292,820	--	Belgium-Luxembourg 105,404; Portugal 51,123; Norway 44,105.
Phosphatic	81,372	67,082	--	Belgium-Luxembourg 43,186; Tunisia 17,228.
Potassic	r371,817	394,648	--	West Germany 132,826; France 57,818; East Germany 50,901.
Other including mixed	113,382	155,748	12,908	West Germany 77,594; Belgium-Luxembourg 44,931.
Ammonia	101,017	160,562	4,992	U.S.S.R. 114,548; United Kingdom 24,037; Venezuela 8,031.
Graphite, natural	892	1,169	3	China, mainland 756; West Germany 281; United Kingdom 80.
Gypsum and plasters	390,339	370,565	68	West Germany 217,336; France 136,150.
Lime thousand tons	1,020	938	--	Belgium-Luxembourg 518; West Germany 420.
Magnesium materials:				
Magnesite	63,032	69,224	43	Greece 35,820; China, mainland 8,279; U.S.S.R. 6,922.
Oxides, hydroxides, peroxides	200	72	--	NA.
Mica:				
Crude including splittings and waste	1,918	2,151	281	Canada 841; Norway 513; United Kingdom 316.
Worked including agglomerated splittings	34	29	NA	Belgium-Luxembourg 10; Switzerland 10.
Pigments, mineral: Iron oxides, processed	14,604	15,111	101	West Germany 12,523; Belgium-Luxembourg 836; Spain 624.
Precious and semiprecious stones, natural and synthetic other than diamond kilograms	56,194	60,885	22,000	West Germany 13,551; Brazil 6,000; United Kingdom 5,230.
Salt	39,567	313,733	NA	West Germany 206,003; Spain 45,537; Italy 24,352.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	127,118	189,967	NA	Belgium-Luxembourg 92,189; West Germany 81,984; East Germany 9,084.
Caustic potash	6,334	6,755	47	France 2,952; Belgium-Luxembourg 2,268; West Germany 666.
Soda ash	47,334	58,080	15,823	East Germany 10,022; West Germany 9,410; France 8,510.
Stone, sand and gravel:				
Dimension stone:				
Unworked and partly worked thousand tons	1,049	1,026	NA	Belgium-Luxembourg 520; West Germany 431.
Worked	66,191	60,890	NA	Italy 31,010; Portugal 8,420; West Germany 7,636.
Dolomite thousand tons	929	995	--	Belgium-Luxembourg 862; West Germany 115.
Gravel and crushed rock do	14,379	15,515	NA	West Germany 9,742; Belgium-Luxembourg 3,238; United Kingdom 1,321.
Limestone do	819	841	--	Belgium-Luxembourg 769; West Germany 39; United Kingdom 33.
Quartz and quartzite	24,954	18,402	513	Norway 13,387; West Germany 1,986.
Sand, excluding metal-bearing thousand tons	8,088	8,120	(1)	West Germany 7,162; Belgium-Luxembourg 862.
Strontium oxide, hydroxide, peroxide	10	193	NA	NA.
Sulfur:				
Elemental	r453,053	455,752	182,024	France 93,445; West Germany 87,414; Poland 86,855.
Sulfur acid, oleum	234,780	370,860	--	West Germany 277,650; Belgium-Luxembourg 44,041.
Talc and steatite	21,192	23,404	1,079	Austria 8,197; Norway 7,234; France 1,859.
Other nonmetals, n.e.s.:				
Crude:				
Quartz, electronic grade kilograms	3	5	NA	NA.
Other thousand tons	r2,003	1,659	1	West Germany 993; Belgium-Luxembourg 631.

See footnotes at end of table.

Table 3.—Netherlands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Other nonmetals, n.e.s. —Continued				
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture thousand tons	r4,021	3,956	NA	West Germany 2,663; Belgium-Luxembourg 1,019; France 269.
Other do.	685	664	NA	West Germany 559; Belgium-Luxembourg 104.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals[3]	133,549	148,093	2,202	Belgium-Luxembourg 86,228; West Germany 26,953.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,726	12,985	1,782	West Germany 11,203.
Carbon black and gas carbon	8,880	9,007	580	West Germany 7,192; United Kingdom 415; Ireland 329.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	5,031	6,211	1,585	West Germany 1,463; Australia 1,366; Poland 705.
Briquets of anthracite and bituminous coal	6,628	6,610	--	West Germany 6,499.
Lignite and lignite briquets	70,454	183,448	--	All from West Germany.
Coke and semicoke	485,404	849,264	53,673	West Germany 650,466; United Kingdom 77,596; France 38,076.
Gas, hydrocarbon:				
Manufactured	109,644	112,884	--	East Germany 69,720; France 21,705; Belgium-Luxembourg 15,720.
Natural million cubic feet	r110,593	115,304	--	West Germany 106,307; Norway 8,997.
Hydrogen, helium, rare gases	3,161	2,883	(1)	Belgium-Luxembourg 2,455; West Germany 274.
Peat including briquets and litter	426,981	476,538	--	West Germany 460,464; Finland 9,410; U.S.S.R. 4,149.
Petroleum and refinery products:[4]				
Crude thousand 42-gallon barrels	394,149	450,862	--	Saudi Arabia 133,019; Nigeria 95,628; Kuwait 63,376.
Refinery products:				
Gasoline do.	r54,380	66,878	33	U.S.S.R. 10,250; Belgium-Luxembourg 9,251; Kuwait 5,146.
Kerosine and jet fuel do.	r3,340	4,656	3	Belgium-Luxembourg 1,108; U.S.S.R. 802; Italy 617.
Distillate fuel oil do.	r21,243	23,944	32	U.S.S.R. 8,023; United Kingdom 3,764; Belgium-Luxembourg 3,557.
Residual fuel oil do.	15,238	25,149	--	Belgium-Luxembourg 5,058; United Kingdom 4,701; Venezuela 2,544.
Lubricants do.	r1,802	2,040	154	Belgium-Luxembourg 677; United Kingdom 284; Italy 279.
Other:				
Liquefied petroleum gas do.	r3,443	5,191	347	United Kingdom 1,805; West Germany 981; Kuwait 659.
Mineral jelly and wax do.	277	432	13	Austria 149; West Germany 109; France 65.
Petroleum coke, bitumen, other residues do.	r3,510	4,231	2,584	West Germany 1,012; Belgium-Luxembourg 496.
Bituminous mixtures do.	250	157	2	West Germany 106; Belgium-Luxembourg 39.
Unspecified do.	r333	269	10	West Germany 196; Belgium-Luxembourg 29; France 26.
Total do.	103,816	132,947		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	598,689	774,889	30,570	West Germany 252,823; Sweden 157,009; United Kingdom 76,947.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]May contain germanium oxide.
[3]Excludes quantities valued at $18,093,448 in 1978 and $24,295,985 in 1979.
[4]Includes bunkers.

COMMODITY REVIEW

METALS

Iron and Steel.—The major Netherlands steel producer, at IJmuiden, was renamed Estel Hoogovens BV by Estel NV, the Netherlands-West German parent company; it was formerly known as Hoogovens IJmuiden BV. The West German affiliate, at Dortmund, was simultaneously renamed Estel Hoesch Werke AG.

Estel, which had suffered a 174 million guilder (f.) loss ($87 million) in 1979, and had hoped to reverse this in 1980, instead reported a record loss of f.488 million ($244 million). Cumulative losses since 1974, shortly after the 1972 merger of the two subsidiaries, totaled about f.1,500 million ($750 million), apparently largely suffered on the West German side. This disparity caused continuing concern and speculation about a possible dissolution of Estel.

A f.1,200 million ($600 million) investment plan for Hoogovens was jeopardized during the year by an "unsatisfactory cash flow," according to the chairman of Estel. The plan was to include modernization of the No. 1 coking plant, and a revamp of the No. 1 hot strip mill. Late in the year the Netherlands Government's National Institute Investment Bank authorized Hoogovens a loan of f.350 million ($175 million); both the coke plant modernization and the steelmaking and processing plant were to be aided. The State aid, the first of its kind in the Netherlands, was considered a "subordinated loan"; i.e., considered as a capital liability. The Netherlands Government owns 28.4% and the City of Amsterdam 8% of Hoogovens; Estel controls the remainder.

In spite of the State assistance, Hoogovens decided at yearend to further reduce its output to 4.8 million tons in 1981. Production in 1980 was about 5 million tons, and capacity is about 7 million tons. Two of the five blast furnaces will remain banked, and short shifts will be worked. There was also expected to be a 3% personnel reduction in 1981, all through attrition.

Magnesium.—Billiton Delfstoffen BV, a subsidiary of Royal Netherlands Shell, was authorized by the Netherlands Government's Department of Economic Affairs to mine 750,000 tons per year of brine containing magnesium and potassium from a maximum depth of 2,000 meters.

Mining will be by Noordelijke Zoutwinning NV, owned equally by Billiton and the Government's Northern Development Co. Starting in 1981 the brine will be used for the production of around 100,000 tons per year of magnesium oxide at the Veendam facility of Magnesia International BV, also owned by Billiton and the Government. Total investment in the mining project was put at f.50 million ($25 million) and the magnesium oxide plant represented a cost of about f.250 million ($125 million).

Zinc.—The electrolytic zinc plant of Kempensche Zink Maatschappij BV, a subsidiary of Shell and Australian Mining and Smelting Ltd. located at Budel near the Belgian border, planned to expand its production capacity to 180,000 tons per year from 150,000 tons (actually exceeded in practice), at a cost of about f.37 million ($18.5 million). Completion was due by April 1981.

NONMETALS

Fertilizer Materials.—N.V. DSM's subsidiary, Unie van Kunstmestfabrieken BV, was planning to close a 150,000-ton-per-year line of ammonia capacity at its Geleen plant, leaving capacity of 300,000 tons. This line was 20 years old and was considered obsolete.

MINERAL FUELS

The Netherlands Government was pursuing an energy policy that included conservation, aiming at an improvement of at least 30% in overall energy efficiency by the year 2000 (presented to Parliament in 1979); increased use of coal (introduced early in 1980 and discussed here last year); and expanded use of nuclear power, if political considerations permit. The net result hoped for was a decrease in the proportion of national energy consumption contributed by domestic natural gas, the country's sole major mineral resource, from 50% at present to 30% in 2000.

Nuclear energy policy remained a large question mark. A decision in 1974 to build three additional nuclear plants (in addition to the commercial plant at Borssele, 470 megawatts electrical) was eventually shelved, but in mid-1980 a Government white paper presented to Parliament resurrected this plan. The white paper made it clear

that the final decision would not be taken by the Government and Parliament until after an extensive public debate, expected to last at least 2 years. A controversial feature of the plan was the possibility that nuclear waste would ultimately be stored underground in the Netherlands' extensive salt domes or on the seabed. Public opposition by many environmental groups continued.

Coal.—The Netherlands, having closed its last coal mine in 1974, remained a relatively small consumer of coal. Of the approximately 6 million tons imported annually, about 4.5 million is used by industry, chiefly iron and steel, and the remaining 1.5 million tons is used by three electric powerplants. The "Coal Memorandum," reported on last year, envisions an increase from 1.5 million tons to 26 million tons by the end of the millenium, when about 40% of electricity will be generated by coal. A contract with Poland for 750,000 tons annually of coking coal was signed in 1977, and another, for steam coal, was signed by the Netherlands Prime Minister on the occasion, late in 1979, of his visit to Warsaw; this called for a total of 8 million tons, to be delivered over 10 years. Under the Government's policy of diversifying supplies, a coal delegation visited the United States in October 1980. Supplies were also being sought from the Republic of South Africa, Canada, and Australia.

Another coal gasification project, the fourth planned in the Netherlands, was announced in June by Esso Nederland BV. An experimental plant in the Rotterdam-Europoort area will gasify 100 tons of coal per day. Construction will commence in 1982, and the plant will start operations in 1985. Design will follow the small unit operated by Exxon Corp. at Baytown, Tex. Total cost will exceed $500 million.

Natural Gas.—The Netherlands Government finally scored a breakthrough in its campaign to increase the export price of natural gas when Ruhrgas of the Federal Republic of Germany accepted a new contract in August. Terms were not announced, but the Netherlands Prime Minister stated that the Netherlands should earn $800 million to $1 billion in additional revenue in 1981 if contracts with all 14 foreign country customers were renegotiated on this same basis. If the gas price is brought into line with that of 1% sulfur fuel oil, as the Netherlands deems equitable, earnings would increase by $2 billion per year over 1980 earnings. In a separate study, the total value of gas production to the Netherlands was estimated at $10 billion, half in exports and half in import substitution.

A contract was being negotiated with Nigeria late in the year for the supply of 0.9 billion cubic meters of liquefied natural gas (LNG) per year by 1985. The Netherlands natural gas supplier, Nederlandse Gasunie NV (subsidiary of Exxon, Shell, and the Netherlands Government) also met with representatives of the Soviet gas company Soyudgas-export and the Soviet trade ministry to discuss importing an estimated 5 billion cubic meters of Siberian gas annually, starting in 1985. It was hoped to obtain a total supply of roughly 14 billion cubic meters of LNG from Algeria and 2.5 billion cubic meters in the pipeline from Norway's Ekofisk Field. However, it was reported late in the year that Algeria's natural gas company, Sonatrach, had announced that its LNG terminal at Arzew would not be built during its current 5-year plan ending in 1984, thus effectively canceling agreements to deliver to the Netherlands and the Federal Republic of Germany. Algeria was known to favor delivering its gas to European customers via the pipeline to Italy now under construction and the Sagamo line to be built through Spain, thus saving the expensive liquefaction facilities at Arzew. It was expected that plans to build a regasification terminal for LNG at Eemshaven would go ahead in spite of the Algerian decision, perhaps being used for the Nigerian gas.

Natural gas reserves in the Netherlands increased slightly, and on January 1, 1980, amounted to 2,327 billion cubic meters, of which 74% was in the Groningen Field in the northeast. A summary of the reserves is presented below:

Area	Proven reserves	Non-proven	Total reserves
Groningen	1,407.7	321.6	1,729.3
Other onshore	103.9	189.5	293.4
Continental Shelf	114.5	189.7	304.2
Total	1,626.1	700.8	2,326.9

At the beginning of the year there were 151 known gas deposits in the Netherlands, of which 90 were on land and 61 in the Netherlands sector of the North Sea.

Petroleum.—Exploration for gas and oil continued apace in the Netherlands, with especially increased activity in the North

Sea. Nevertheless, indigenous crude oil production contributes less than 3% of total crude consumption, and that, to date, has been from onshore fields.

Offshore, the Netherlands subsidiary of Union Oil Co. of California, having located oil in its Helm Field of Block Q1 in 1979, in 1980 discovered additional oil in the Helder Field and in a separate structure 3.5 miles north, both also in Block Q1. The latest discoveries were in shallow (75 feet) water some 23 miles from the Netherlands coast. The flow rate in Q1 was 1,446 barrels of 25.5 gravity from the interval 5,289 feet to 5,312 feet. Reserves in this block were estimated at 14 million barrels, and Union Oil, in cooperation with Royal Nedlloyd, requested approval to start production; this would be the first commercial oilfield in the Netherlands offshore. Nederlandse Aardolie Maatschappij (NAM) also filed an application for a production license for its Block F 3, where estimated reserves are 44 million barrels.

Total crude oil reserves in the Netherlands as of January 1, 1980, were as follows, in millions of barrels:

Area	Proven reserves	Non-proven	Total reserves
Schoonebeck (Eastern Region)	44.0	164.2	208.2
Rijswijk (Western Region)	25.7	37.4	63.1
Continental Shelf	38.1	31.5	69.6
Total	107.8	233.1	340.9

All production in the Netherlands was by NAM, a joint venture of Shell and Esso, of which the Netherlands Government owns half. In October, NAM brought additional facilities into operation, which should have the effect of roughly doubling annual production from 14,000 barrels per day to about 28,000 barrels per day.

Total primary distillation capacity of the eight Netherlands refineries reportedly dropped slightly to 84.8 million metric tons (about 1.6 million barrels per day) in 1980. There was a moderate rise in utilization of capacity in 1979 to about 72%. Netherlands refineries continued to function chiefly as balancing refineries, with over 60% of their production sold abroad in the Federal Republic of Germany, the United Kingdom, Belgium, and Denmark. Consequently the decline in consumer and industrial demand for petroleum products has been harder on them than on European refineries with a broad base of domestic consumption.

[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from the Netherlands guilder to U.S. dollars at the rate of f.2.0=US$1.00, the approximate average rate in 1980.

The Mineral Industry of New Zealand

By Charlie Wyche[1]

New Zealand's mineral industry showed little change during 1980, and production of most mineral commodities was at about the same level as that of 1979. Construction materials (aggregates, clay, limestone, and sand and gravel) remained the most active industry and the value of this production was the greatest of any mineral product. Coal, iron sands, natural gas, and a little gold and silver accounted for essentially all of the remaining mineral value. Several prospects, including asbestos, gold, and molybdenum, were being investigated and could contribute to the mineral value by 1985.

The Government announced comprehensive plans for energy development based on the country's large reserves of natural gas. Gas-based projects are expected to cost $2.5 billion during the next few years, and will include substantial foreign direct investment. It is planned to produce synthetic fuel, compressed natural gas, liquid petroleum gas, a methanol plant, and an ammonia-urea plant from the natural gas.

To meet energy supply problems, New Zealand established a Department of Energy. This new department intends to strengthen and unify the country's energy administration by bringing together the Ministry of Energy Resources and Electricity, and the Mines Department. In addition, a Liquid Fuels Trust Board was created to finance research into indigenous transport of fuels, especially those that could be derived from natural gas.

The Natural Gas Corp. and the Offshore Mining Co. combined to form the Petroleum Corp. of New Zealand Ltd., which would be responsible for the Government's oil exploration. Exploration programs to prove New Zealand's resources of petroleum, coal, and geothermal and hydroelectrical energy were being intensified.

The only export commodities of any importance were titaniferous iron sands and small quantities of steel products. Crude oil and refinery products were the principal commodities imported, and they supplied about one-third of the national energy requirements. Planned development of coal, natural gas, hydroelectric power, and geothermal power were expected to reduce petroleum imports to 20%-25% of the total energy requirement by 1990.

PRODUCTION

New Zealand's value of mine and quarry output for 1980 (metals and nonmetals, but not the mineral fuels) was estimated at $160 million,[2] 0.8% of the gross national product of $17.3 billion. Values of the most significant minerals produced during 1979 (in thousand dollars) were as follows: Sand and gravel ($55,000); coal ($50,000); iron sand concentrate ($25,000); limestone for agriculture, roads, cement, and other industries ($14,000); clays for brick, tile, and pottery ($2,000); and gold ($3,000).

Natural gas production, with associated condensates, was playing an increasingly important role in New Zealand's energy program. Natural gas and some condensate were produced at the Kapuni offshore field and the gas was supplied to Auckland, Wellington, and the New Plymouth and Stratford power stations.

Table 1.—New Zealand: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal, smelter	139,800	r145,100	151,100	154,100	2156,200
Copper ore and concentrate	--	154	38	40	35
Gold, mine output, metal content, troy ounces	3,276	7,168	7,011	7,500	7,300
Iron and steel:					
Iron ore, gross weight	185	200	170	250	280
Iron sand, gross weight[3]	2,473,672	r2,954,400	3,946,400	3,527,500	3,000,000
Sponge iron, thousand tons	e50	12	28	27	30
Crude steel, do.	e200	r225	226	r e200	200
Silver, mine output, metal content, troy ounces	1,000	7,572	2,006	e2,000	2,100
Tungsten, mine output, metal content	8	6	9	e9	8
Zinc ore and concentrate	--	132	e140	e140	150
NONMETALS					
Cement, hydraulic, thousand tons	999	910	798	756	2612
Clays:					
Bentonite	1,042	r2,600	9,800	10,000	10,000
Fire clay	260,811	173,008	118,734	e140,000	145,000
Kaolin (including china clay)	58,834	94,742	33,741	e32,000	33,000
Diatomite	e3,000	1,113	e1,000	e1,000	1,000
Magnesite	805	r600	840	e850	870
Perlite	1,500	1,000	558	e900	1,000
Pumice	50,232	28,550	39,468	e40,000	41,000
Salt	43,000	53,000	65,000	e70,000	75,000
Sand and gravel:					
Glass sand	142,955	146,486	127,998	e135,000	136,000
Common sand and gravel[4], thousand tons	20,881	21,477	20,306	e23,000	23,700
Stone:					
Dolomite	23,129	23,070	e24,000	e25,000	25,000
Greenstone	6	r3	10	e10	10
Limestone and marl:					
For agriculture, thousand tons	1,686	1,732	1,615	e1,700	1,760
For roads, do.	274	308	250	e300	320
For industry, except cement, do.	165	170	159	e175	180
For cement, do.	1,674	1,590	1,366	e1,500	1,600
Serpentine, do.	72	89	116	e90	85
Unspecified:					
Dimension	26,328	16,828	e20,000	e20,000	21,000
Rock for harbor work, thousand tons	3,200	3,300	e3,400	e3,400	3,500
Sulfur[e]	1,000	1,000	1,000	1,000	1,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous, thousand tons	445	389	364	383	390
Subbituminous, do.	1,872	1,817	1,669	1,355	1,530
Lignite, do.	170	162	151	209	192
Total, do.	2,487	2,368	2,184	1,947	2,112
Coke, gashouse, do.	41	93	e100	100	110
Fuel briquets, do.	11	13	e15	15	15
Gas, natural:[5]					
Gross[e], million cubic feet	32,000	51,000	49,000	34,300	236,300
Marketed, do.	30,945	49,426	47,466	33,493	235,329
Natural gas liquids, thousand 42-gallon barrels	86	100	46	46	246
Petroleum:					
Crude[6], do.	3,776	5,391	4,555	2,992	22,509
Refinery products:					
Gasoline, do.	12,052	10,846	10,057	10,888	29,954
Distillate fuel oil, do.	5,168	4,894	4,692	4,864	24,692
Residual fuel oil, do.	7,795	7,093	5,668	5,854	25,241
Other, do.	674	780	600	e650	493
Refinery fuel and losses, do.	1,704	939	695	e700	570
Total, do.	27,393	24,552	21,712	22,956	20,950

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Sept. 1, 1981.

[2]Reported figure.

[3]Average 57% Fe.

[4]Includes crushed rock for building aggregate, roads, and ballast.

[5]Excludes carbon dioxide component of natural gas, which is reported separately.

[6]Includes field condensate.

TRADE

According to the Department of Statistics at Wellington, principal mineral exports during fiscal year 1980 (year ending June 30, 1980) were aluminum and aluminum alloys ($165.5 million) and iron ore and concentrates ($29.2 million).

Crude petroleum, partly refined petroleum, and petroleum refinery products dominated mineral imports; they were valued at $900 million in fiscal year 1980. Iran remained the principal import source, but Kuwait and Saudi Arabia were also significant suppliers. Imports of iron and steel, mainly semimanufactures, and aluminum oxide, totaled $218.3 million and $42.6 million, respectively. Phosphate rock from Nauru, sulfur from the United States, and alumina from Australia were also imported by New Zealand during 1980.

The Government was preparing to begin exporting up to 250,000 tons of coal annually from the Buller Coalfield located in the northwest area of Southland. The trade, estimated at $10 million annually, would constitute the first major coal export of recent times. Probable customers are Hong Kong, Japan, the Republic of Korea, Singapore, and Taiwan.

Table 2.—New Zealand: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	53	--		
Metal including alloys:				
Scrap	1,540	1,583	--	Japan 1,271; Italy 301; Australia 10.
Unwrought	r114,658	143,258	--	Japan 132,396; Hong Kong 4,603; Australia 4,125.
Semimanufactures	1,522	2,000	41	Australia 557; Singapore 326; Malaysia 203; United Arab Emirates 129.
Copper:				
Ore and concentrate	613	--		
Metal including alloys:				
Scrap	800	1,797	--	Australia 923; West Germany 345; Netherlands 249.
Unwrought and semimanufactures	r1,952	2,114	344	Singapore 604; Malaysia 482; Australia 195.
Gold metal, unwrought and semimanufactures, troy ounces	--	2,034	--	United Kingdom 951; Australia 903; Republic of South Africa 171.
Iron and steel:				
Ore and concentrate, thousand tons	3,079	3,002	--	Japan 2,910; Republic of Korea 91.
Metal including alloys:				
Scrap	1,391	1,519	6	Japan 1,463.
Semimanufactures:				
Pig iron, spiegeleisen, sponge iron, ferroalloys	4	8	--	Mainly to Australia.
Ingots, blooms, billets, sheet bars	r15,687	4,924	--	Fiji 4,914.
Bars, rods, angles, shapes, sections	34,797	36,460	3,993	China, mainland 24,022; Fiji 4,936; Republic of Korea 2,114.
Universals, plates, sheets	41,574	58,151	43,307	Pakistan 3,743; Papua-New Guinea 2,920.
Hoop and strip	21	45	--	Australia 27; Fiji 8; Singapore 7.
Rails and accessories	1	18	--	Fiji 13.
Wire	r6,632	6,114	4,262	Hong Kong 751; Australia 228.
Tubes, pipes, fittings	1,018	12,058	--	China, mainland 8,884; Trinidad and Tobago 1,738.
Castings and forgings, rough	139	134	2	Australia 125.
Total	r99,873	117,912		
Lead:				
Oxides	55	--		
Metal including alloys:				
Scrap	481	1,454	--	Japan 1,120; Taiwan 143; Australia 106.
Unwrought and semimanufactures	240	121	--	Fiji 39; Australia 38; Singapore 28.

See footnotes at end of table.

Table 2.—New Zealand: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
METALS —Continued				
Magnesium metal including alloys, all forms	3	--		
Platinum-group metals and silver:				
Ores and concentrates, value	r$316,576	$597,666	--	United Kingdom $562,428; Australia $35,238.
Metals including alloys, all forms:				
Platinum-group, troy ounces	56	97	--	All to United Kingdom.
Silver, do.	1,423	80	--	Australia 49; New Hebrides 31.
Zinc metal including alloys:				
Scrap and blue powder	910	570	--	Taiwan 196; Australia 146; Japan 90.
Unwrought and semimanufactures	146	901	--	Taiwan 455; Japan 190; Australia 149; West Germany 104.
Other metals, n.e.s.:				
Ores and concentrates	51	--		
Ash and residue containing nonferrous metals, value, thousands	r$173	$146	--	Japan $105; Australia $35; Spain $6.
Oxides, hydroxides, peroxides of metals, n.e.s, value	r$43,940	$120	--	All to Fiji.
Precious metals, n.e.s., waste and sweepings, do.	--	$261,496	--	Australia $227,441; United Kingdom $34,055.
NONMETALS				
Abrasives, natural, n.e.s.: Pumice, emery, corundum, etc	r310	45	(2)	Australia 35; Hong Kong 5.
Cement	1,085	1,420	--	Western Samoa 469; Norfolk Island 386; Nauru 250.
Clays and clay products including all refractory brick:				
Crude clays, n.e.s	655	6,637	(2)	Australia 5,342; Japan 889; Taiwan 224.
Products:				
Refractory including nonclay bricks, value, thousands	r$94	$87	$1	Fiji $55; Australia $11.
Nonrefractory, do.	r$499	$628	(2)	Australia $483; Singapore $63; Fiji $34.
Fertilizer materials:				
Crude:				
Phosphatic	14	2	--	All to Fiji.
Potassic	3	--		
Other	51	242	--	Australia 177; French Polynesia 48.
Manufactured:				
Nitrogenous	532	257	--	Tonga 135; Australia 50; American Samoa 46.
Phosphatic	3,379	6,448	--	Fiji 6,421.
Potassic	654	2,281	--	Fiji 2,274.
Other including mixed	312	1,916	--	Western Samoa 1,846; French Polynesia 54.
Lime	44	36	--	Norfolk Island 15; Papua-New Guinea 15.
Precious and semiprecious stones, value, thousands	r$11	$727	$278	Australia $421; Saudi Arabia $16.
Salt	1,606	3,020	--	Australia 2,480; Tonga 148.
Stone, sand and gravel:				
Gravel and crushed rock	66	182	NA	Australia 180.
Sand excluding metal-bearing	64	350	--	Australia 216; Fiji 95; Republic of South Africa 30.
Limestone	40	73	--	Australia 38; Fiji 26.
Other nonmetals, n.e.s.:				
Crude	2,344	1,413	1	Australia 1,401.
Slag, dross, and similar waste, not metal-bearing	19	--		
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s., value, thousands	r$1,887	$2,500	--	Fiji $1,483; Papua-New Guinea $581.

See footnotes at end of table.

Table 2.—New Zealand: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Destinations, 1978-79	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	508	--		
Coal, all grades including briquets	10,981	1	--	All to Canada.
Coke and semicoke	5,002	15,401	--	Australia 8,958; Republic of Korea 6,442.
Peat including peat briquets and litter	--	1,932	46	Australia 1,774.
Petroleum refinery products:				
Distillate fuel oil thousand 42-gallon barrels	978	873	--	Ship bunkers 856; Gilbert Islands 17.
Residual fuel oil ---do---	1,273	1,376	--	Ship bunkers 1,175; Singapore 201.
Lubricants ---do---	r8	10	--	Fiji 5; Singapore 1; Western Samoa 1.
Mineral jelly and wax ---do---	r(2)	(2)	--	Mainly to Australia.
Bituminous mixtures ---do---	r4	13	--	Western Samoa 6; New Caledonia 3.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals value, thousands	r$15	$10	--	Fiji $8.

rRevised. NA Not available.
[1]Data are for fiscal years ending June 30 of that stated.
[2]Less than 1/2 unit.

Table 3.—New Zealand: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	635	153	--	Guyana 103; China, mainland 50.
Oxide and hydroxide	331,403	320,599	73	Australia 318,824; Japan 1,140.
Metal including alloys:				
Unwrought	180	263	2	Australia 223; United Kingdom 38.
Semimanufactures	2,539	3,723	275	Australia 2,295; Japan 555.
Arsenic trioxide, pentoxide, acids	1,872	2,070	2	United Kingdom 1,820; China, mainland 120.
Chromium oxide and hydroxide	159	161	32	United Kingdom 56; West Germany 53.
Cobalt oxide and hydroxide	7	17	9	Belgium 7.
Copper metal including alloys:				
Unwrought	1,241	2,454	--	Australia 2,051; West Germany 389.
Semimanufactures[2]	11,061	11,712	12	Australia 10,543.
Gold metal, nonmonetary, unwrought and semimanufactured troy ounces	7,763	5,397	21	Australia 4,293; United Kingdom 969; Italy 64.
Iron and steel:				
Ore and concentrate	128	260	--	Australia 206; Ghana 54.
Metal including alloys:				
Scrap	16,962	1,475	NA	Fiji 1,291.
Pig iron, ferroalloys, similar materials	5,246	5,770	75	Australia 3,274; Republic of South Africa 1,321.
Steel, primary forms	4,863	8,817	(3)	Australia 8,718.
Semimanufactures:				
Bars, rods, angles, shapes, sections	70,063	77,600	619	Australia 44,297; Japan 20,580.
Universals, plates, sheets	318,040	358,910	642	Japan 255,575; Australia 81,805.
Hoop and strip	27,563	23,787	10	Australia 16,309; Japan 5,116; United Kingdom 1,340.
Rails and accessories	4,316	17,292	1	Australia 11,732; Japan 4,999.
Wire	13,755	15,009	34	Australia 6,215; Japan 4,180.
Tubes, pipes, fittings	22,828	23,287	670	Japan 14,119; Australia 5,340; United Kingdom 1,705.
Castings and forgings, rough	719	566	(3)	United Kingdom 294; Australia 272.
Lead:				
Oxides	165	309	36	Australia 264.
Metal including alloys, unwrought	8,629	7,673	19	Australia 7,624.
Magnesium metal including alloys, unwrought	124	240	82	Norway 104; Australia 37.

See footnotes at end of table.

Table 3.—New Zealand: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate	14	104	1	Ghana 101.
Oxide	1,140	903	168	Japan 259; Australia 231; Ghana 227.
Molybdenum metal including alloys, unwrought value, thousands	$10	$18	$2	Australia $13.
Nickel metal including alloys:				
Unwrought	100	38	--	Mainly from Canada.
Semimanufactures	236	206	61	United Kingdom 64; Australia 49.
Platinum-group metals and silver:				
Waste and sweepings value, thousands	r$341	$525	(3)	Australia $524.
Metals including alloys:				
Platinum-group thousand troy ounces	2	2	(3)	West Germany 1.
Silver do	1,524	1,758	3	Australia 1,727.
Tin:				
Oxides	8	12	3	Japan 4; Australia 3.
Metal including alloys:				
Unwrought	249	236	--	Australia 200; Malaysia 33.
Semimanufactures	8	24	(3)	Australia 14; United Kingdom 9.
Titanium oxides	2,041	2,752	66	Australia 1,324; Japan 612; West Germany 285.
Tungsten metal including alloys, all forms value, thousands	r366	$9	$1	Australia $4.
Zinc:				
Oxide	55	36	(3)	Canada 18; West Germany 9; Australia 5.
Metal including alloys:				
Unwrought	17,311	20,255	3	Australia 19,463; Canada 783.
Semimanufactures	293	915	10	Canada 707; Australia 87; West Germany 60.
Other:				
Ores and concentrates of molybdenum, tantalum, titanium, vanadium, zirconium	259	179	--	Australia 171.
Oxides, hydroxides, peroxides of metals n.e.s	441	221	32	Norway 68; United Kingdom 63; Japan 19; Australia 14.
Metal including alloys, all forms:				
Metalloids value, thousands	r$338	$518	$1	Republic of South Africa $278; France $168.
Base metals, n.e.s do	r$410	$272	$16	China, mainland, $165; Australia $51.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, corundum, etc	92	155	118	Italy 18; United Kingdom 11.
Grinding and polishing wheels and stones value, thousands	r$1,447	$1,565	$244	United Kingdom $432; Australia $408; Japan $180.
Asbestos	8,525	9,818	11	Canada 9,047; Republic of South Africa 737.
Barite and witherite	1,169	1,582	--	China, mainland 750; Australia 628; Singapore 118.
Boron materials:				
Crude natural borates value, thousands	r$2,571	$8,156	$8,106	United Kingdom $49; West Germany $1.
Oxide and acid	384	840	838	United Kingdom 1.
Cement	3,117	3,820	50	Japan 1,872; United Kingdom 565; Thailand 507.
Chalk	707	658	3	United Kingdom 408; France 215.
Clays and clay products including all refractory brick:				
Crude clays, n.e.s	7,885	7,170	3,592	Australia 1,787; United Kingdom 1,489.
Products:				
Refractory including nonclay brick value, thousands	r$5,785	$6,796	$1,028	Australia $2,396; United Kingdom $1,679.
Nonrefractory do	r$862	$853	$31	Japan $354; United Kingdom $311.
Diamond:				
Gem, not set or strung do	r$2,606	$3,137	$1	India $1,620; Israel $885.
Industrial do	r$87	$156	$50	Australia $84; Republic of South Africa $18.

See footnotes at end of table.

Table 3.—New Zealand: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
NONMETALS —Continued				
Diatomite and other infusorial earth	555	700	570	Japan 123.
Feldspar, fluorspar, nepheline syenite	1,747	997	--	Norway 412; Canada 235; China, mainland 202.
Fertilizer materials:				
Crude:				
Nitrogenous	263	(3)	--	All from Australia.
Phosphatic thousand tons	1,137	1,349	55	Nauru 626; Australia 623.
Manufactured:				
Nitrogenous	81,093	85,803	10,577	Japan 47,869; Australia 8,985; Republic of Korea 7,450.
Phosphatic	5,448	10,721	6,987	Republic of Korea 3,114.
Potassic	235,573	221,733	165,070	Canada 40,737; U.S.S.R. 15,460.
Other including mixed[4]	29,722	40,296	35,791	Republic of Korea 2,085; West Germany 1,713.
Ammonia	471	499	1	Australia 497.
Graphite, natural	137	68	(3)	Sri Lanka 30; Norway 19; Australia 9.
Gypsum and plasters	140,610	98,970	43	Australia 89,190; Japan 9,196.
Magnesite	r978	4,617	42	China, mainland 2,801; Australia 1,745.
Mica:				
Crude including splittings and waste value, thousands	r$73	$153	$28	India $43; Australia $29; United Kingdom $19.
Worked including agglomerated splittings do	r$187	$346	$50	France $71; Denmark $44; Ireland $39; Australia $30.
Pigments, mineral:				
Natural, crude	219	292	8	Austria 210; West Germany 41.
Iron oxide, processed	717	1,006	45	West Germany 707; Spain 136; Australia 58.
Precious and semiprecious stones, except diamond:				
Natural value, thousands	r$1,081	$1,904	$8	Australia $868; U.S.S.R. $420.
Manufactured do	r$52	$52	$1	West Germany $29; France $11; Switzerland $10.
Salt	58,737	32,610	46	Netherlands Antilles 32,100.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	20,416	19,820	3,572	United Kingdom 12,467; West Germany 2,659.
Caustic potash and sodic and potassic peroxide	809	423	64	United Kingdom 188; West Germany 83; Italy 36.
Stone, sand and gravel:				
Dimension:				
Crude and partly worked	919	865	18	Republic of South Africa 533; Italy 185; Norway 76.
Worked value, thousands	r$466	$295	$44	Italy $202.
Quartz and quartzite	126	69	3	Sweden 46; United Kingdom 10.
Sulfur, elemental, other than colloidal	234,899	257,986	168	Canada 257,601.
Talc, steatite, soapstone, pyrophyllite	2,623	3,181	41	Australia 2,923; China, mainland 152; India 40.
Other, n.e.s.:				
Crude value, thousands	r$100	$137	$5	Republic of South Africa $42; Norway $36; China, mainland $16.
Oxides and hydroxides of magnesium, strontium, barium	1,720	965	68	Australia 776; West Germany 97; Japan 13.
Bromine, iodine, fluorine	9	12	(3)	Japan 10.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s. value, thousands	r$139	$183	$104	United Kingdom $59.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	8,319	7,923	48	Australia 7,676.
Coal including briquets	1,362	1,010	821	Canada 92.
Coke and semicoke	2,231	1,871	1	Australia 1,870.
Gas, hydrocarbon value, thousands	r$77	$79	$23	France $33; Netherlands $20.
Hydrogen and rare gases	764	699	102	Australia 596.
Peat including peat briquets and litter	77	47	--	Ireland 30; Norway 17.

See footnotes at end of table.

Table 3.—New Zealand: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977-78	1978-79	Sources, 1978-79	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude and partly refined:				
Crude				
thousand 42-gallon barrels	12,378	13,517	--	Saudi Arabia 6,376; Iran 2,544; Kuwait 2,347.
Partly refined ---do---	4,898	5,814	--	Australia 2,104; Kuwait 1,102; Bahrain 831.
Refinery products:				
Gasoline ---do---	4,244	3,988	13	Australia 1,695; Bahrain 1,052; Singapore 698.
Kerosine and jet fuel ---do---	2,839	2,449	2	Australia 1,434; Singapore 846.
Distillate fuel oil ---do---	3,521	3,074	--	Australia 1,754; Bahrain 727; Singapore 589.
Residual fuel oil ---do---	14	(3)	(3)	
Mineral jelly and wax ---do---	30	31	3	United Kingdom 12; China, mainland 6; Australia 3.
Lubricants[5] ---do---	990	426	23	Australia 262; Singapore 116.
Other:				
Nonlubricating oils, n.e.s. do---	63	2	2	Switzerland.[3]
Pitch and pitch coke do---	85	87	(3)	Mainly from Australia.
Bituminous mixtures, n.e.s. do---	2	6	(3)	United Kingdom 4.
Petroleum coke[6] ---do---	295	464	464	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals value, thousands	r$1,726	$2,314	$638	Japan $1,297; Australia $228.

rRevised. NA Not available.
[1]Data are for fiscal years ending June 30 of that stated.
[2]Excludes copper foil and copper powder valued at $1,577,464 in 1977-78 and $2,364,522 in 1978-79.
[3]Less than 1/2 unit.
[4]Excludes quantities valued at $45,367 in 1977-78 and $112,004 in 1978-79.
[5]Excludes quantities valued at $282,876 in 1977-78 and $341,975 in 1978-79.
[6]Excludes quantities valued at $462 in 1977-78.

COMMODITY REVIEW

METALS

Aluminum.—New Zealand Aluminium Smelters Ltd. (NZAS), at present New Zealand's only aluminum smelting operation, was engaged in an expansion project which would increase its annual production capacity by 57% over the present 150,000 tons per year. The expansion is scheduled for completion in 1983. Comalco Ltd. of Australia, in which the U.S. firm Kaiser Aluminum & Chemical Corp. has a major interest, owns 50% of NZAS and two Japanese firms own the remainder. Although the smelter was the subject of some criticisms by environmentalists, NZAS enjoys considerable support from a large majority of the residents in New Zealand's Southland area where the plant is located.

The New Zealand Government approved the construction of a smelter on South Island by CSR Ltd. The total cost of the smelter was estimated by CSR Ltd. and partners (Swiss Aluminium Ltd. and Fletchers Holdings Ltd.) at $640 million. The first stage, with a single potline capacity of 100,000 tons per year, would be commissioned by the mid-1980's, and a second potline of 100,000 tons per year would be added by 1990.

New Zealand Aluminium Smelters Ltd.'s current output accounts for over 1% of the total world production of aluminum metal. The completion of the current expansion project and the scheduled new construction project would increase New Zealand's share of world aluminum production to about 3%.

Approximately 80% of NZAS's output of 150,000 tons per year of aluminum was exported and the remaining 20% was used by New Zealand fabricators to produce a wide range of aluminum products for domestic needs. Aluminum exports went primarily to Japan and Southeast Asia. Under

the terms of the agreement with the New Zealand Government, the Japanese partners exported their combined 50% share.

Gold.—Mine production of gold declined slightly in 1980 from that reported for 1979. Kanieri Gold Dredging Ltd. produced 6,000 troy ounces of gold in 1980 from 2,700,000 million cubic meters of gravel in the Taramakau River, near Kumaru, South Island. The alluvial gold being mined was among the lowest grade in the world. Three percent uranite was also contained in the alluvial sands, and tests were currently underway to see if the uranite could be sold as a byproduct. The Kanieri gold dredging operation is a wholly owned subsidiary of Amoil New Zealand Ltd. All gold from the Kanieri operation was purchased by the Government. Because of the high gold prices in 1980, interest in possible gold-bearing areas remained high over the past year. This has led to large-scale dredging operations being proposed for the west coast of South Island.

Mineral Resources (New Zealand) Ltd. continued exploration throughout 1980 at the Marthu Mine, Waihi, North Island. Mine dumps at Union Hill were being worked, and bulk samples were evaluated. Blackwater Gold Ltd. and Carpentaria Exploration Co. Pty. Ltd. continued testing ore extensions at a former property of Blackwater Mines. Amoco Minerals New Zealand Ltd. began prospecting in the Monowai gold area.

Iron Sands.—The mining of titanomagnetite (iron sands) was by far New Zealand's largest metallic mineral industry, and second only to sand and gravel in tonnage and value of output. In terms of value, iron sands accounted for 16% of all nonfuels mineral output and over 85% of all metallic ore production. Output of iron sand concentrate by the two producing companies New Zealand Steel Mining Ltd. (a wholly owned subsidiary of New Zealand Steel Ltd.) and Waipipi Ironsand Ltd. was substantially below that of 1979. The decline was attributed to the cutback in steel production by the Japanese steel industry, New Zealand's principal customer. Although these two companies were the sole source of iron ore for New Zealand's iron and steel industry, about 90% of the iron sands were exported.

The iron sand deposits consist of extensive, horizontal beds located on or near the western coast of New Zealand's North Island. The deposits range from 5 to 20 meters thick and contain concentrations of up to 17% titanomagnetite sand grains. The grains originated from nearby andesite volcanic formations and were sorted and concentrated by wind, stream, and wave action. The three sand deposits currently being worked commercially were at Waverley, Taharoa, and North Waikato. The Waverly deposit was being mined by Waipipi Ironsands Ltd., and the other two by New Zealand Steel Ltd., which also owns the Glenbrook Steel Works, New Zealand's only steel plant.

Steel.—New Zealand Steel produced iron sands at its Waikato North Head deposit for use in its direct-reduction steelmaking plant at Glenbrook. The plant at Waikato North Head was designed to produce 200,000 tons per year of concentrate, but in 1978 the capacity was expanded to 250,000 tons of concentrate. About 200,000 tons of raw steel was produced during 1979 and about 220,000 tons was produced in 1980. This figure is expected to increase to about 750,000 tons per year within 10 years. A cold-rolling mill and coat line for plain and galvanized sheet were being considered. Long-range plans included a new melt shop, continuous-slab facilities, and more direct-reduction kilns.

Other Metals.—In 1980, the Department of Scientific and Industrial Research continued its investigation of black, heavy-metal beach sand deposits on the west coast of South Island. The sands contain gold, ilmenite, monazite, and zircon.

Amoco Minerals New Zealand Ltd. was conducting airborne magnetometry on the Ceromandel Peninsula, North Island, for base metals. Otter Minerals Exploration Ltd., in partnership with Gold Mines of New Zealand Ltd., continued exploration in Nelson Province and the drilling operation on D'Urville Island. Gold Mines of New Zealand Ltd., a partnership of Australian Anglo American Corp. Ltd. and Amoil New Zealand Ltd., remained active in the Raukumara, East Cape, and Kaikoura regions.

NONMETALS

Asbestos.—Chrysotile asbestos, mainly associated with serpentines, occurs at a number of locations on South Island. However, further work is required to determine the limits of mineralization. The most significant deposits were those of the northwest Otago (Pyke River) area, but no production was reported in 1980.

Phosphates.—The most promising source

of phosphate was thought to be the nodules occurring on the sea floor on the eastern half of the Chatham Rise (west of Chatham Island). Research carried out by the New Zealand Oceanographic Institute in 1979 indicated the presence of phosphorite nodules ranging from 10 to 150 millimeters in diameter. Most of the deposits were found in water from 400 to 500 meters deep and none were found in depths less than 200 meters. The P_2O_5 values for the phosphorites generally range between 18% and 24%, with the highest recorded content 27.7%. Evaluation is continuing.

Sulfur.—Fletcher Mining Co. Ltd. has ceased excavating and development work on a deposit of sulfur at Rotokawa in the Taupo area, North Island. The deposit, with reserves estimated at 6 million tons, was mixed with pumice and research on the development of a separation process was not completed. The Frasch process cannot be applied here owing to the porosity of the overlying beds. Further development will await conclusion of research and finance.

Other Nonmetals.—In 1980, serpentine was mined at Piopio (near Te Kuiti) and North Cape on North Island, and Lee Valley, Collins Valley, and Mossburn on South Island. At Lake Grassmere, in Marlborough (South Island), salt was produced by the solar evaporation of seawater.

An analysis by the Department of Scientific and Industrial Research (DSIR) of beach sands on the west coast of South Island indicated reserves of over 50 million tons of ilmenite bearing sands. DSIR was conducting extensive laboratory tests aimed at producing a synthetic rutile from the rather low-grade (46% TiO_2) ilmenites.

MINERAL FUELS

Coal.—New Zealand produced 2.0 million tons of coal in 1980 from about 70 mines in various fields on North and South Islands. Nearly 75% of the production was from open pit mines. There was an increase in production from private mines, and development work on three new coal mines was on schedule. Prospecting for new deposits on both North and South Islands continued during the year. On North Island, extensive exploration drilling took place at Maramarua, Rangiriri, Huntly, and Ohinewai, with smaller drilling programs at Naike, Waerenga, Whatawhata, and Lake Waikare. On South Island, work commenced on the Greymouth Coalfield with reserves of 2 million tons being indicated in the Strongman West Block of this field. In addition, 4.4 million tons of lignite with open cast mining potential have been outlined in eastern Southland during a major drilling program.

A coal mining bill introduced into Parliament was being examined by Parliament's select committee on commerce and mining. The coal mining bill would give the Government much more control of all private coal mining without involving the Government with taking over the ownership of land or coal mines. Under the proposals all coal mining activity would be licensed by the Minister of Energy.

The Department of Mines' 5-year coal exploration program estimates recoverable coal reserves at 1.2 billion tons. However, measured reserves of coal totaled 210 million tons. The exploration program started in the eastern part of the Southland lignite field, Mataura Valley, South Island, and was to continue in the Waikato area, North Island, and in the west coast deposits, South Island.

Natural Gas.—The Maui offshore gasfield came onstream in 1979, but at severely restricted rates because of a lack of market for the gas. Only 6 of the 14 wells completed on the Maui-A platform were onstream. In addition to Maui, New Zealand's Kapuni Field on North Island's west coast was producing about 6.2 million cubic meters per day of natural gas and some condensate. This was a significant drop from 1979, as production was cut back to allow gas from the Maui Field to enter the market. The Government has a take-or-pay contract for the Maui gas, necessitating its production.

The Government was encouraging increased exploration by foreign companies by liberalizing its handling of taxes, allowing more writeoffs such as exploration and development losses against other operations in New Zealand. Field development costs can be written off at a rate of 20% per year, beginning in the year of the first commercial production.

Petroleum.—The Government's comprehensive petroleum exploration policy is now in effect. In instances where the Government accepts a company's petroleum exploration proposal, it would retain the right to acquire a 51% interest in the discovery in exchange for a 40% contribution to the exploration the Government would accept a lower share of the venture. Should either party to such an arrangement decide not to contribute to the costs of a particular well, the remaining parties could proceed on a sole risk basis. In the event of a discov-

ery, the parties contributing to the cost of drilling would be permitted to recover 60% of their expenditure as a prior charge against first production. Royalties to be paid to the Government on oil found were set at 12.5% of sale value. The price of indigenous oil was raised to that of world crude.

New Zealand's only known major oil resources were in the Maui and Kapuni natural gasfields. Production by Shell-BP-Todd Oil Services (in equal partnership with the Government) continued to increase over that of the previous year. A light crude oil, or condensate, was produced as a joint venture with the natural gas.

Shell-BP-Todd signed an agreement with the Government of New Zealand to undertake a $40 million, three-well oil search on the western tip of North Island. Drilling began in mid-1980. New Zealand Petroleum, a local exploration firm in which Triton Oil of Dallas (United States) has an interest, also resumed its oil search off the southwest coast of South Island.

Production of liquefied petroleum gas at Kapuni reached a record high level, but market demand still exceeded supply. An extraction plant being constructed to strip liquefied petroleum gas from the Maui gas stream was on schedule and could be operational in 1981. Proposals from distributors to import liquefied petroleum gas from Australia were under consideration by the Government, and were expected to be approved during the year.

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, value has been converted from New Zealand dollars ($NZ) to U.S. dollars at the rate of $NZ1.00=US$0.99, the average exchange rate as of January-June 1980.

The Mineral Industry of Nigeria

By George A. Morgan[1]

Although a slight decline in crude oil output occurred in Nigeria, petroleum remained the mainstay of the economy in 1980. Three increases in crude oil prices during the year added substantially to Government revenue. The Government emphasized completion of the steel plants at Ajaokuta and Aladja in order to diversify the economy and to reduce the high level of iron and steel imports. The gross domestic product was estimated at $94 billion,[2] about 25% higher than the 1979 estimate. Petroleum revenue accounted for over 80% of Government income, and revenue from the sale of oil increased 40% to $24 billion. At yearend, foreign exchange reserves were nearly double the previous years to over $10 billion. The country entered a period of higher inflation, although official estimates of inflation were under 10%. Government expansion of the minimum wage for the public sector led to increased pressure by the private sector for similar treatment. A number of strikes occurred, some in critical industries such as oil refining and steel plant construction.

The Fourth National Development Plan, covering the period 1981 through 1985, called for Government investment of $152 billion. Included in the plan was $2.2 billion to be allocated for a new standard gage railroad from Port Harcourt to the Ajaokuta steel plant. Construction startup of the liquefied natural gas (LNG) facility near Port Harcourt was being reexamined because of the financial strain it was expected to make on other Government projects. Environmental impact statements were to be required on all major projects after January 1, 1981.[3]

PRODUCTION AND TRADE

Output of crude oil increased to 2.2 million barrels per day by yearend 1980 after a sharp decline from 2.1 million barrels per day early in the year to 1.6 million barrels per day in September. The major cause for the decline was lower world market demand. However, the potential shortfall in world supply of crude oil following the outbreak of hostilities between Iran and Iraq led to the yearend production increase. About 140 oilfields were in production in the Niger delta swamps, most with output under 10,000 barrels per day. The Government's plan for allocation of total revenue, most of which was derived from petroleum, among 19 States was met with disapproval by the five oil producing States. Division of total revenue as proposed by the Federal Government was to be 55% to the Federal Government, 30% to State governments, 8% to local governments, and the remaining 7% to a special fund. Included in the fund were monies to be made available as compensation for States with oil wells.

The Government lessened its pressure on imports by exempting spare parts and industrial raw materials from preshipment inspection requirements as of March 1, 1980. Only established manufacturers could receive exemption for raw materials imported. The inspections were performed by the Société Generale de Surveillance as part of a Government program instituted on January 1, 1978, to reduce the trade deficit.

Table 1.—Nigeria: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Columbium and tantalum concentrates, gross weight:					
Columbite	708	861	666	567	[2]521
Tantalite	1	1	1	1	[e2]2
Iron and steel: Crude steel	15,000	15,000	15,000	15,000	15,000
Lead:					
Mine output, metal content[e]	130	70	50	70	70
Metal, refined, secondary	--	--	--	1,500	2,000
Rare-earth metals: Monazite concentrate[e]	20	20	20	20	20
Tin:					
Mine output, cassiterite concentrate:					
Gross weight	5,050	4,630	4,011	3,824	3,714
Sn content	3,710	3,267	2,935	2,750	2,527
Metal, smelter	3,667	3,315	2,984	2,858	2,684
Tungsten ore and concentrate, gross weight	[3]	--	--	--	--
Zinc ore and concentrate, metal content[e]	450	--	--	--	--
NONMETALS					
Cement, hydraulic thousand tons	1,274	1,440	1,536	1,740	2,000
Clays, unspecified	1,000	1,208	[e]1,500	620	[2]19,438
Feldspar[e]	5,000	5,000	5,000	5,000	5,000
Stone:					
Limestone thousand tons	[e]1,640	1,243	[e]1,200	2,006	[2]2,078
Marble	[e]4,900	6,065	[e]6,000	1,031	[2]150
Shale thousand tons	[e]197	[e]165	NA	149	[2]187
MINERAL FUELS AND RELATED MATERIALS					
Coal do	312	238	264	172	193
Gas, natural:					
Gross million cubic feet	764,000	757,320	721,405	[e]820,000	[e]750,000
Marketed do	18,500	17,657	13,420	[e]18,100	[e]19,000
Petroleum:					
Crude thousand 42-gallon barrels	756,064	761,025	697,150	841,325	753,980
Refinery products:					
Gasoline do	5,270	6,169	17,749	8,395	[e]10,600
Jet fuel do	1,080	964	6,784	160	[e]200
Kerosine do	1,921	1,445	--	4,585	[e]5,800
Distillate fuel oil do	5,161	4,891	12,817	8,760	[e]11,000
Residual fuel oil do	6,661	3,687	8,427	10,220	[e]12,800
Lubricants do	399	--	--	--	--
Other, unspecified do	220	438	9,220	730	[e]900
Refinery fuel and losses do	479	528	1,650	1,460	[e]1,800
Total do	21,191	18,122	56,647	34,310	[e]43,100

[e]Estimated. [p]Preliminary. NA Not available.
[1]Includes data available through August 3, 1981.
[2]Figures reported to the U.S. Bureau of Mines but noted as estimates in source.
[3]Less than 1/2 unit.

Table 2.—Nigeria: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Destinations, 1977	
			United States	Other (principal)
METALS				
Columbium and tantalum ores and concentrates	1,036	NA	NA	NA.
Copper:				
Matte	5	NA	NA	NA.
Metal including alloys, semimanufactures	--	117	--	All to Japan.
Iron and steel metal:				
Scrap	336	NA	NA	NA.
Semimanufactures	702	(1)	(1)	(1)
Lead ore and concentrate	40	NA	NA	NA.

See footnotes at end of table.

Table 2.—Nigeria: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Destinations, 1977	
			United States	Other (principal)
METALS —Continued				
Tin:				
Ore and concentrate value, thousands	--	$931	--	All to Netherlands.
Metal including alloys, all forms	3,419	1,896	--	United Kingdom 1,442; Netherlands 454.
Uranium ore and concentrate	35	NA	NA	NA.
Zinc ore and concentrate	71	NA	NA	NA.
Zirconium ore and concentrate	3	NA	NA	NA.
Other:				
Ores and concentrates	462	3,648	190	United Kingdom 1,737; Netherlands 1,659; Japan 25.
Metals including alloys, all forms	1,526	(2)	(2)	(2)
NONMETALS				
Fertilizer materials, crude	11	NA	NA	NA.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	545	2,249	--	Netherlands 848; United Kingdom 563.
Coal, all grades	10,416	4,000	--	All to Ghana.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	754,098	736,902	317,904	Netherlands 67,587; United Kingdom 56,635; France 52,922.
Refinery products:				
Gasoline ---do---	216	71	NA	Niger 15.
Jet fuel ---do---	65	NA	NA	NA.
Kerosine and white spirit ---do---	96	289	NA	Niger 138.
Distillate fuel oil ---do---	380	463	NA	Niger 217; Cameroon 13.
Residual fuel oil ---do---	4,329	1,520	1,509	NA.
Lubricants ---do---	12	NA	NA	NA.
Bitumen and bituminous mixtures, n.e.s ---do---	148	NA	NA	NA.

NA Not available.
[1] Quantity unreported; reexports valued at $2,839,000, mainly to the United States and Canada.
[2] Quantity unreported; exports valued at $556,000, mainly to West Germany and the United Kingdom.

Table 3.—Nigeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	5,334	4,024	--	Canada 2,562; Norway 655.
Semimanufactures	12,127	15,124	441	United Kingdom 4,846; Switzerland 3,216; West Germany 2,185.
Copper metal including alloys:				
Unwrought	102	116	--	West Germany 104.
Semimanufactures	4,535	5,556	77	Canada 2,029; United Kingdom 977; Japan 826.
Iron and steel:				
Ore and concentrate, including roasted pyrite	1,944	NA	NA	NA.
Metal:				
Scrap	491	NA	NA	NA.
Pig iron, sponge iron, powder, shot, etc	r243	221	NA	NA.
Ferroalloys	--	893	NA	NA.
Steel, primary forms	90,339	81,334	4,463	Belgium-Luxembourg 19,824; West Germany 18,896; United Kingdom 11,495.
Semimanufactures:				
Bars, rods, angles, shapes, sections value, thousands	$177,214	$197,789	$3,452	West Germany $53,431; United Kingdom $36,087; Belgium-Luxembourg $18,852.

See footnotes at end of table.

Table 3.—Nigeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Universals, plates, sheets thousands tons	618	1,047	4	Japan 794; West Germany 71; United Kingdom 56.
Hoop and strip	82,485	97,657	--	Belgium-Luxembourg 52,375; United Kingdom 22,609; Japan 10,974.
Rails and accessories	1,793	11,804	6,025	Italy 2,429; West Germany 888.
Wire	38,950	132,398	1,352	United Kingdom 105,183; West Germany 9,280.
Tubes, pipes, fittings value, thousands	$128,445	$211,191	$16,254	Japan $64,799; West Germany $41,812; United Kingdom $32,920.
Castings and forgings, rough	2,807	92,408	NA	West Germany 10,591; United Kingdom 3,637.
Lead metal including alloys:				
Unwrought	154	557	NA	United Kingdom 387; Netherlands 69.
Semimanufactures	177	112	NA	NA.
Nickel metal including alloys:				
Unwrought kilograms	85	--		
Semimanufactures	19	60	NA	United Kingdom 55.
Platinum-group metals including alloys, unwrought or partly wrought troy ounces	1,813	(1)	(1)	((1)
Silver:				
Ore and concentrate[2]	2	NA	NA	NA.
Metal including alloys, unwrought or partly wrought troy ounces	1,262	NA	NA	NA.
Tin metal including alloys:				
Unwrought	978	183	--	Canada 93; Netherlands 20; Finland 17.
Semimanufactures value, thousands	--	$46	$3	NA.
Uranium and thorium ores and concentrates do	--	$142	--	West Germany $138.
Zinc metal including alloys:				
Unwrought	9,961	11,577	22	Zaire 5,230; United Kingdom 3,099; Belgium-Luxembourg 2,002.
Semimanufactures	172	201	NA	United Kingdom 81; Senegal 29.
Other:				
Ores and concentrates	36	2,034	NA	NA.
Oxides, hydroxides, peroxides	--	6,546	NA	United Kingdom 5,000; West Germany 681.
Metals including alloys, all forms	9,497	(3)	(3)	(3)
NONMETALS				
Abrasives, n.e.s.:				
Natural	664	(4)	(4)	(4)
Grinding and polishing wheels and stones	1,233	1,142	34	United Kingdom 532; Italy 197; West Germany 194.
Asbestos	55,258	55,689	--	Canada 24,215; West Germany 9,548; Italy 8,436.
Cement thousand tons	1,988	4,827	68	Greece 833; Spain 734; United Kingdom 471.
Clay products:				
Refractory including nonclay brick	6,541	20,677	477	West Germany 10,060; United Kingdom 4,387; Italy 2,242.
Nonrefractory	21,030	30,640	80	Italy 14,126; West Germany 6,077; Spain 2,914.
Diamond, industrial value, thousands	$46	NA	NA	NA.
Fertilizer materials:				
Crude	427,791	(5)	(5)	(5)
Manufactured:				
Nitrogenous	90,814	56,924	--	Belgium-Luxembourg 23,247; West Germany 15,380.
Phosphatic	99,098	53,515	NA	United Kingdom 15,329; West Germany 9,774; Yugoslavia 9,590.
Potassic	5,762	30,993	NA	West Germany 7,968; Netherlands 7,000; Belgium-Luxembourg 6,788.
Other including mixed	12,183	16,843	--	West Germany 14,601.
Ammonia	690	NA	NA	NA.
Lime	17,576	138,640	NA	United Kingdom 136,512; West Germany 1,372.
Mica, all forms	106	NA	NA	NA.
Pigments, mineral, including processed iron oxides	6,762	NA	NA	NA.
Precious and semiprecious stones, excluding diamond[6] value, thousands	$1,556	$1,842	--	India $1,582; West Germany $170.
Salt	289,859	881,463	1,545	United Kingdom 785,191; West Germany 51,091; Poland 18,871.

See footnotes at end of table.

Table 3.—Nigeria: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	Sources, 1977	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s.:				
Caustic soda	24,388	NA	NA	NA.
Caustic potash	6,751	NA	NA	NA.
Stone, sand and gravel:				
Dimension stone, worked	1,111	(7)	(7)	(7)
Gravel and crushed rock	3,646	1,071	NA	Spain 399; United Kingdom 321.
Sulfur, all types, excluding sublimated	865	1,195	NA	Italy 651; West Germany 286; Netherlands 30.
Other:				
Crude	1,145	NA	NA	NA.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals	444,620	66,324	765	Spain 21,927; United Kingdom 19,730; France 4,997.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	175,297	671,798	3,307	United Kingdom 462,763; Morocco 50,328; Netherlands 26,598.
Coal, all grades, including briquets	4,171	176	--	United Kingdom 175; West Germany 1.
Coke and semicoke	1,181	2,264	--	West Germany 1,414; United Kingdom 800.
Gas, natural and manufactured value, thousands	$717	$1,171	NA	France $483; Netherlands $323; United Kingdom $149.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	6,754	2,231	--	Netherlands Antilles 1,032; Netherlands 524.
Kerosine and white spirit do.	1,983	930	11	Netherlands 391; Netherlands Antilles 385.
Jet fuel do.	679	NA	NA	NA.
Distillate fuel oil do.	2,637	1,400	NA	Netherlands Antilles 806; Netherlands 379.
Residual fuel oil do.	60	93	--	Netherlands Antilles 79; Netherlands 14.
Lubricants do.	575	(8)	(8)	(8)
Mineral jelly and wax do.	72	(9)	(9)	(9)
Bitumen and bituminous mixtures do.	4,598	NA	NA	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11,249	71,265	NA	France 33,633; United Kingdom 29,799.

rRevised. NA Not available.
[1]Quantity unreported; imports valued at $144,000.
[2]May include platinum-group metals.
[3]Quantity unreported; imports valued at $5,025,000 mainly from Canada and West Germany.
[4]Quantity unreported; imports valued at $401,000, mainly from the United States.
[5]Quantity unreported; imports valued at $15,552,000, mainly from West Germany and the United Kingdom.
[6]May include pearls.
[7]Quantity unreported; imports valued at $14,581,000, mainly from Japan.
[8]Quantity unreported; imports valued at $43,414,000, mainly from the United Kingdom, Netherlands, and Italy.
[9]Quantity unreported; imports valued at $12,730,000, mainly from the United Kingdom and West Germany.

COMMODITY REVIEW

METALS

Bauxite.—Nigeria and Ghana held preliminary negotiations on the possible joint exploitation of the bauxite deposits at Kibi in Ghana.[4] Located approximately 80 kilometers from the coast, the deposit had reserves of 182 million tons of ore.

Iron Ore.—About $275 million was allocated for development of the iron ore deposit at Itakpe Hill in Kwara State.[5] Several hundred million tons were located at the site, with production forecast at 7.3 million tons per year of iron ore for blast furnace reduction at the Ajaokuta steel plant currently under construction. Associated Ores Mining Co. Ltd. was to work the deposit and provide for transportation of output to the steel plant.[6]

Iron ore for the Midrex direct-reduction process at the Aladja sponge iron plant near Warri was to be imported, although ore from Itakpe Hill may also be used.

Iron and Steel.—Development of infrastructure continued with construction of housing units and 60 kilometers of rail

linking the Itakpe iron ore deposit with the Ajaokuta steel complex. The U.S.S.R. commenced shipment of equipment for the plant which was to use conventional blast furnace technology. The first phase of production, planned for June 1983, would require consumption of 2 million tons of iron ore, 1.2 million tons of coking coal, 700,000 tons of limestone, 240,000 tons of dolomite, and 90,000 tons of manganese ore annually.[7] Initial production was to be light sections and wire rod. The second phase of output could total 2.6 million tons per year, including production of billets and medium sections. Upon full completion, the plant was expected to yield 5.2 million tons of steel per year. About $920 million has been spent for the facility thus far.

About $827 million has been spent for construction of the Midrex direct-reduction plant at Aladja, near Warri. Trial production of billets and rods at the adjacent Delta steel plant was scheduled for July 1981. Employment was to reach 6,000 at the Aladja project and 10,000 at Ajaokuta.[8]

Three steel rolling mills were under construction at Jos, Katsina, and Oshogbo. The Jos and Katsina mills were to be commissioned about September 1982, each with an initial capacity of 220,000 tons per year. The Oshogbo steel rolling mill, valued at $143 million, was to initially produce 210,000 tons per year of rods and bars. Ultimate capacity was to increase to 720,000 tons per year.

Tin.—Realization of majority control of tin mining companies by the Government-owned Nigerian Mining Corp. (NMC) through implementation of the Nigerian Enterprise Promotion Decree of 1977 continued in 1980. NMC gained 60% control of Gold & Base Metal Mines of Nigeria Ltd. at a price of $1.83 per share. Bisichi-Jantar Nigeria Ltd. was also 60% owned by NMC, with Bisichi Tin. Co. Ltd. and Jantar Ltd. of the United Kingdom each retaining 20% ownership. Permission from the Government was required for the transfer of dividends and capital funds from the Nigerian-based concern to the two London shareholders.[9]

Amalgamated Tin Mines of Nigeria Ltd. announced that it planned to conduct a mining feasibility study on a sub-basalt tin find. Location of the deposit was not reported.

Uranium.—The Nigerian Uranium Mining Co., headquartered at Gombe in Bauchi State, conducted exploration for uranium in the Gombe area. The company was 60% Government-owned through NMC, and 40% controlled by Minatome. Exploration by the company was restricted to the Gombe area, with other areas available to interested organizations.

NONMETALS

Fertilizer Materials.—A phosphate rock deposit at Ifo in Ogun State was reported to have 40 million tons of reserves. Beneficiation produced a concentrate yielding 78% tricalcium phosphate. A $600 million contract was signed with Kellogg Fertilizer Co. for construction of a fertilizer plant utilizing the Ifo deposit. Other potential deposits were located in the States of Imo, Oyo, and Ondo.

The Government-owned Federal Superphosphate Fertilizer Co., the sole producer of manufactured fertilizer in the country, produced about 40,000 tons of single superphosphate at its Kaduna plant. Capacity of the plant was 100,000 tons per year. Output accounted for only about 14% of the country's total consumption; the remainder was imported.

Limestone.—Although limestone has been found in every State, total reserves were unknown, and only a few deposits were exploited. Most limestone quarrying has been for production of cement, and some has been used as a flux by the Makeri Tin Co. at Jos. Over 110 million tons of limestone in beds varying in thickness from 3 to 10 meters were located at Nkalagu in Anambra State. The Nigerian Cement Co. was the sole operator of the deposit. A 35-million-ton limestone deposit at Ewekoro in Ogun State was being quarried by the West African Portland Cement Co., and at Yandev a 70-million-ton deposit was worked by the Benue Cement Co. The purity level of the limestone at Calabar, currently worked by the Calabar Cement Co. for cement production, was sufficient for its projected use as a fluxing agent at the iron and steel plant under construction at Ajaokuta.[10]

MINERAL FUELS

Coal.—It was reported that the two underground mines at Enugu in Anambra State, which were recently equipped with mechanized longwalls at a cost of $37 million, had experienced operational problems. Technicians from Katowice Arebow (KOPEX) of Poland, which installed the equipment, were called upon to rectify the problem at the Onyeama and Okpara Mines. A

coal washery with a 250-ton-per-hour capacity was also completed by KOPEX at a cost of $25 million. Production at Enugu was to yield 2 million tons per year of coal.[11]

A coke plant was planned for the opencast mine at Okola, but had not received Government financial support by yearend 1980. Production at the mine was to be expanded to 500,000 tons per year by 1985.

The 1975-80 5-year plan had envisaged considerable contribution from the coal industry to the country's energy sector. However, production from Enugu must be blended with imported coal to produce coking coal suitable for use in blast furnaces under construction at Ajaokuta. This process was expected to continue until coking coal from the Obi and Lafia Coalfields in Benue State was brought into production. About 125,000 tons per year of coal were consumed for production of cement at Nigerian Cement Co. Ltd.'s plant at Enugu. The coal-fired electric generating station at Oji in Anambra State used the remaining coal produced. No coal was available for export.

Natural Gas.—A military decree of September 1979 required oil companies to submit to the Government by October 1980 plans for utilizing associated gas that was currently being flared. All flaring of associated gas was expected to be halted by January 1, 1984. About 95% of all associated gas produced was flared, and there was no production of nonassociated gas. The crude oil equivalent of natural gas reserves was reported to exceed crude oil reserves. Proved gas reserves were estimated to be 80% nonassociated gas.[12]

The construction of a LNG plant near Port Harcourt was expected to utilize about 16 billion cubic meters per year of the approximately 21.5 billion cubic meters currently produced. Phillips, operator for the 60% State-owned consortium, called for tenders for design and construction of the plant. Profitability of the plant was to be guaranteed by 15- to 20-year supply contracts with eight European companies. Capital cost for the project, which was to have six process units, were estimated at $12 billion.

Power stations at Ijora, Delta, and Afam utilized gas turbine generating units, while the 750-megawatt Sapele steam turbine station burned gas from nearby fields. Additional utilization of flared gas was planned by the construction of a 750-megawatt thermal power station in Lagos, which was to be supplied by a 200-mile trunk gas line. Operation of the Lagos plant was to commence in 1984, utilizing 300 to 500 million cubic feet per day of natural gas. The Afam and Sapele power stations were to be expanded to utilize 140 and 150 million cubic feet per day, respectively. Natural gas was also expected to be used as feedstock for a fertilizer plant.

Petroleum.—*Production.*—Output of crude oil was down in 1980 from 1979, mainly as a result of lower world demand. However, output was also affected somewhat because of a well blowout in the Funiwa Field and the closure of a Shell oil facility at Opuna in Bendel State. Production in Nigeria fell from about 2.1 million barrels per day in early 1980 to 1.6 million barrels per day in September. Overall reduction in output for the year was limited to about 10% as the Iraq-Iran conflict resulted in losses of crude oil supplies to the world market which led to production increases elsewhere.

The Nigerian National Petroleum Corp. (NNPC), established in 1977, was the majority holder of most oil-producing groups operating in Nigeria. It generally controlled about 60% of the assets of private oil companies except for 80% control of Shell's operations. The British Petroleum portion of Shell was nationalized in August 1979. In August 1980, the NNPC was found to have inappropriately conducted some of its administrative procedures by a Government tribunal investigation of possible misallocation of funds. The tribunal also declared that three oil companies—Shell, Mobil, and Gulf—were to allocate nearly 183 million barrels of crude oil to the Federal Government for failure to maintain production levels as proscribed by the NNPC.[13] The amount was later reduced to 80 million barrels.

Shell was the principal crude oil producer, with about 57% of total output, followed by Gulf, Mobil, and Azienda Generale Italiani Petroli S.p.A. (AGIP). Private companies sought renegotiation of profit margins in order to obtain a more realistic return on investment, as well as redefinition of terms for new product sharing contracts. Reexamination of private company crude oil production levels in conjunction with sales by NNPC was also expected to take place.

Exploration.—The Government announced that NNPC was to spend nearly $890 million in 1980-81 (April-March) fiscal year for exploration and development. The NNPC employed 4,300 people, with an in-

crease to 20,000 employees expected in 5 years. All reserve acreage belonging to NNPC, as well as offshore areas, were opened to exploration. However, the volume of newly discovered oil to be used in refineries outside the country was predicted to be small. In addition, exploration was to be aimed primarily at increasing the reserve-production ratio, rather than expanding output, which was to remain at about 2.15 million barrels per day.[14] Only three companies took preliminary action to acquire concessions on the newly offered acreage, AGIP, Elf-Nigeria Ltd., and Crown Central Petroleum Co. of the United States in association with Nigus Petroleum of Nigeria. These three companies also commenced operations in the Niger Delta and the Anambra Basin on concessions they had acquired the previous year. The NNPC contracted seismic studies in the Chad and Anambra Basins through a French company while undertaking its own seismic studies in Abudu in Bendel State, in parts of Benue and Ondo States, and offshore both rivers and Bendel State.

Refining.—Emphasis was placed on expanding domestic crude oil refining capacity in order to reduce imports of refined products and to increase local use of oil and gas. Three refineries were operational in Nigeria at yearend 1980. The crude oil refinery at Kaduna, 100% owned by NNPC, was inaugurated in October, with a capacity of 100,000 barrels per day. Feedstock for fuel production was Nigerian crude oil, while Venezuelan crude was used in production of lubricants, waxes, and asphalt. The heavy Venezuelan oil was obtained through crude oil bartering. The refinery at Warri, inaugurated in September 1978, was 100% controlled by NNPC, with a capacity of 100,000 barrels per day. However, because of technical problems, it operated at 50,000 barrels per day. The Port Harcourt refinery had a capacity of 60,000 barrels per day. Ownership was 80% by NNPC and 20% by Shell. Plans were being prepared for an additional 200,000-barrel-per-day capacity at the Port Harcourt oil refinery.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Nigerian naira (N) to U.S. dollars at the rate of N1.00=US$1.75 for 1979 and N1.00=US$1.84 for 1980.

[3]U.S. Embassy, Lagos, Nigeria. State Department Telegram 10092, Sept. 17, 1980.

[4]U.S. Embassy, Lagos, Nigeria. State Department Airgram A-7, Mar. 2, 1981.

[5]Daily Times (Lagos). Itakpe Iron Project. Oct. 15, 1980, p. 5.

[6]New Nigerian (Kaduna). Iron Ore Deposits Reported Found in Kwara State. Sept. 10, 1981, p. 1.

[7]———. Steel Workers to Have New Pay. Fringe Benefits Structure. Oct. 25, 1980, p. 1.

[8]The Financial Times (London). Bisichi Tin. No. 28,203, June 27, 1980, p. 25.

[9]Mining Magazine (London). Nigerian-Ghanaian Bauxite Co-op? V. 143, No. 4, October 1980, p. 343.

[10]Odukwe, G.C. Industrial Minerals of Nigeria. 40th Industrial Minerals International Congress, 1980.

[11]The Financial Times (London). Nigeria: Twenty Years of Independence. No. 28,405, Sept. 29, 1980, pp. I-XXIV.

[12]Oil & Gas Journal. Vast Gas Program Looms In Nigeria. V. 79, No. 2, Jan. 12, 1981, pp. 60-61.

[13]New York Times. Nigeria to Penalize Royal Dutch, Mobil and Gulf in Dispute. Sept 9, 1980.

[14]Petroleum Economist (London). New Exploration Offer Expected. V. 47, No. 5, June 1980, pp. 204-206.

The Mineral Industry of Norway

By Joseph B. Huvos[1]

In 1980, production in Norwegian industry, with the exception of the oil sector, moved only sluggishly. This was because Norway's most efficient industrial sectors, including the major export industries such as aluminum, base metals, and ferroalloys, had already been operating close to capacity for some time. Conversely, other industries such as iron and steel, which were less competitive in export markets, had unused capacity and therefore expected no expansion. Norway's gross national product (GNP) at current prices was about $50.7 billion,[2] an increase in real terms of only 3% compared with the 1979 GNP. Per capita GNP was $12,400, the retail sales price index rose 4.5%, and unemployment was only 1% during the year.

There were few changes in Norway's mineral industry, although the Government released its white paper on energy. Commissionings included a Svalbard coal mine, a northern quartzite mine, and a northern hydroelectric plant. A rare-earth mineral deposit in the north, and several oilfields in the North Sea were discovered. Drilling was started in the North Sea, north of the 62d parallel. Elkem Spigerverket AS purchased Union Carbide's ferroalloy plant, and Norsk Hydro AS bought the Nederlandse Stikstof Maatschappij, a producer of fertilizer materials.

PRODUCTION

In 1980, there was no important change in the mineral industry's production except for continued expansion of the oil and gas sector. Production of major mineral commodities in 1980 and the 4 previous years is shown in table 1.

Table 1.—Norway: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal:					
Primary ingot	617,579	[r]622,730	638,559	659,818	[2]651,651
Secondary ingot	14,915	9,474	6,634	[e]9,000	[2]12,362
Superpure	4,700	4,700	4,700	NA	NA
Cadmium metal, smelter	80	97	120	115	[2]130
Cobalt metal	576	705	522	953	[2]1,275
Copper:					
Mine output, metal content of concentrate	31,080	[r]29,053	29,073	28,016	[2]28,869
Metal:					
Smelter, primary only	23,393	26,575	20,061	27,357	[2]33,690
Refined:					
Primary	17,757	[r]21,237	15,674	20,964	[2]25,785
Secondary	6,217	1,294	5,578	6,000	6,000
Total	23,974	[r]22,531	21,252	26,964	31,785

See footnotes at end of table.

Table 1.—Norway: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Iron and steel:					
Iron ore and concentrate ___ thousand tons__	3,972	3,635	3,773	4,249	[2]3,807
Roasted pyrite _____do____	155	147	158	[e]110	110
Pig iron _____do____	656	512	554	651	[2]618
Ferroalloys:					
Ferrochrome _____do____	31	22	15	12	[2]11
Ferrochromium silicon _____do____	1	([3])	1	1	([2 3])
Ferromanganese _____do____	349	244	273	338	[2]287
Ferrosilicon (75% basis) _____do____	278	223	266	349	[2]307
Silicon metal _____do____	[r]64	[r]60	58	[e]70	85
Ferrosilicomanganese _____do____	168	127	134	184	[2]163
Other _____do____	31	31	30	29	[2]7
Total _____do____	[r]922	[r]707	777	983	860
Steel, crude _____do____	909	711	812	921	[2]866
Semimanufactures:					
Rolled _____do____	666	500	644	741	750
Finished castings _____do____	14	10	4	6	10
Lead:					
Mine output, metal content _____	3,861	3,265	3,561	3,596	[2]3,258
Smelter, secondary only _____	613	911	917	400	400
Magnesium metal, primary _____	38,808	38,165	39,160	44,177	[2]44,400
Nickel:					
Concentrate, metal content _____	525	[r]543	536	500	500
Metal, primary _____	32,685	[r]38,222	23,739	30,643	[2]36,937
Platinum-group metals[4] _____troy ounces__	48,676	39,867	33,630	37,327	NA
Titanium:					
Ilmenite concentrate _____	766,664	828,503	766,990	819,711	[2]627,814
Dioxide _____	[e]25,000	NA	NA	NA	NA
Vanadium, mine output, metal content[e] _____	530	540	460	[r]570	540
Zinc:					
Mine output, metal content _____	[r]29,317	[r]31,277	29,592	29,592	[2]28,670
Metal, primary _____	64,352	69,790	71,628	77,495	[2]79,056
NONMETALS					
Cement, hydraulic _____ thousand tons__	2,686	[r]2,314	2,232	2,197	[2]2,093
Feldspar, lump[5] _____	37,690	70,799	59,522	87,888	[e]70,000
Graphite _____	9,071	9,097	11,151	11,892	[2]10,780
Lime, hydrated, and quicklime _____	90,243	102,268	126,364	[r e]130,000	130,000
Mica[4] _____	3,083	2,818	2,688	2,915	2,900
Nitrogen: N content of ammonia _____	473,333	504,521	526,458	544,532	[2]515,078
Olivine sand _____	529,291	350,635	606,087	791,988	NA
Pyrite and pyrrhotite, gross weight _____	367,588	[r]308,338	293,289	233,678	[2]378,673
Sodium and potassium compounds, n.e.s.:					
Caustic soda _____	74,605	[r]74,058	101,686	176,019	[2]183,554
Sodium carbonate[e] _____	23,000	25,000	26,000	[r]27,000	27,000
Stone:					
Dimension stone: Slate _____	51,535	58,941	51,813	NA	NA
Crushed and broken:					
Dolomite:					
Ground _____	NA	66,175	80,322	97,111	NA
Not further described _____	467,346	512,040	510,681	513,350	NA
Limestone _____ thousand tons__	5,189	4,607	4,390	5,254	NA
Nepheline syenite _____	216,607	209,689	231,273	241,131	[2]232,132
Quartz and quartzite _____	724,029	600,676	672,744	639,487	NA
Other[6] _____ thousand tons__	1,106	NA	NA	NA	NA
Sulfur:					
Pyrite, S content _____do____	188	[r]154	150	119	[2]193
Byproduct of:					
Metallurgy _____do____	33	38	36	40	40
Petroleum _____do____	7	7	7	6	6
Total _____do____	228	[r]199	193	165	239
Sulfuric acid (100%) _____	405	[r]383	381	386	[2]354
Talc, soapstone, steatite:					
Unground _____	50,639	33,564	35,754	34,294	33,000
Other _____	67,572	64,523	60,962	53,191	52,000
Total _____	118,211	98,087	96,716	87,485	85,000

See footnotes at end of table.

Table 1.—Norway: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades	524,729	436,784	402,084	259,280	[2]283,412
Coke, all grades	282,562	[r]320,715	320,205	336,541	[2]343,941
Gas:					
Manufactured ---- million cubic feet	895	729	579	563	[2]458
Natural:					
Gross[e] ---- do	110,000	160,000	550,000	790,000	960,000
Marketed ---- do	([7])	[r]110,855	525,865	759,482	[2]922,065
Peat:[e]					
For agricultural use	60,000	60,000	60,000	[r]250,000	250,000
For fuel use	1,100	1,100	1,100	[r]5,000	5,000
Petroleum:					
Crude ---- thousand 42-gallon barrels	101,900	101,887	127,163	140,111	[2]181,692
Refinery products:					
Gasoline, motor ---- do	8,915	10,030	7,490	10,318	[2]9,941
Jet fuel ---- do	1,715	2,446	1,762	1,956	[2]1,321
Kerosine ---- do	1,299	2,219	2,807	3,663	[2]3,548
Distillate fuel oil ---- do	25,566	20,657	23,728	27,534	[2]25,966
Residual fuel oil ---- do	17,534	17,023	11,674	14,601	[2]11,876
Lubricants ---- do	59	287	33	30	[2]31
Other ---- do	5,525	5,361	1,721	6,381	[2]6,545
Refinery fuel and losses ---- do	2,923	4,215	5,981	5,013	[2]3,342
Total ---- do	63,536	62,238	55,196	69,496	[2]62,570

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through July 1, 1981.
[2]Reported figure.
[3]Less than 1/2 unit.
[4]Data represent exports, presented in lieu of actual production data, which are reported in official sources as not available for publication. A part of these exports may be derived from imported materials.
[5]Excludes nepheline syenite, which is included under "Stone."
[6]Excludes a quantity of stone reported at 4,774,485 cubic meters in 1976 and subsequently not reported.
[7]A small quantity may have been used for fuel in the fields, but there was essentially no marketed production.

TRADE

In 1980, Norway's trade surplus became substantial, owing to further increases in oil and gas production and the rise in the price of hydrocarbons. There was little change in the general trade pattern of the remaining mineral commodities, consisting principally of raw material imports for energy-intensive industries such as aluminum, and exports of oil and finished metals. Norway's mineral commodity trade in 1978 and 1979 is shown in tables 2 and 3.

Table 2.—Norway: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina	1	20	NA	NA.
Metal including alloys:				
Scrap	21,520	23,841	NA	West Germany 10,998; Brazil 3,423; Sweden 2,736.
Unwrought	630,241	565,304	37,244	West Germany 157,069; United Kingdom 122,790; Sweden 53,887.
Semimanufactures	56,826	65,196	10,424	United Kingdom 14,645; Denmark 8,419; West Germany 3,483.
Cadmium metal including alloys, all forms	97	156	NA	NA.
Cobalt metal including alloys, all forms	559	885	NA	NA.
Copper:				
Ore and concentrate	98,239	98,797	--	West Germany 69,320; Sweden 27,924; Finland 1,553.
Oxide and hydroxide	2,752	2,892	NA	NA.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Copper —Continued				
Metal including alloys:				
Scrap	4,221	4,569	--	West Germany 2,422; Sweden 1,077; Belgium-Luxembourg 445.
Unwrought:				
Unrefined	5,586	6,192	--	All to West Germany.
Refined	16,201	21,652	228	West Germany 7,397; France 4,125; Sweden 4,006.
Semimanufactures	1,815	2,935	NA	Sweden 1,291; West Germany 717; United Kingdom 518.
Gold metal, unworked or partly worked troy ounces	5,112	4,405	32	Denmark 3,054; Finland 675.
Iron and steel:				
Ore and concentrate, except roasted pyrite thousand tons	3,074	3,409	--	West Germany 1,850; United Kingdom 625; Poland 431; France 188.
Roasted pyrite	48,047	27,684	NA	West Germany 13,906; Denmark 7,594; United Kingdom 6,164.
Metal including alloys:				
Scrap	36,146	38,025	--	West Germany 17,742; Sweden 8,241; Denmark 3,718.
Pig iron including cast iron	106,518	140,198	--	United Kingdom 50,711; West Germany 24,936; Switzerland 17,332.
Ferroalloys:				
Ferromanganese	218,863	245,588	49,879	West Germany 44,969; Sweden 31,336; Belgium-Luxembourg 20,972.
Other	561,156	562,824	21,010	West Germany 154,510; United Kingdom 125,121; Sweden 49,511.
Steel, primary forms	217,526	239,469	--	Netherlands 137,762; West Germany 27,875; United Kingdom 23,728.
Semimanufactures:				
Bars, rods, angles, shapes, sections	184,553	245,318	4,067	United Kingdom 72,624; Sweden 52,880; West Germany 46,928.
Universals, plates, sheets	128,788	134,899	NA	United Kingdom 43,557; Sweden 32,520; Denmark 23,715.
Hoop and strip	3,886	7,162	5	Sweden 5,242; Denmark 1,772.
Rails and accessories	1,853	2,787	--	West Germany 2,126; Sweden 622.
Wire	7,230	7,967	1,043	United Kingdom 2,450; Iraq 1,230; Portugal 616.
Tubes, pipes, fittings	34,640	40,051	2,371	United Kingdom 4,987; Sweden 852; Belgium-Luxembourg 500; France 481.
Total	360,950	438,184		
Lead:				
Ore and concentrate	4,432	6,293	--	All to West Germany.
Oxides	38	29	--	Ethiopia 20.
Metal including alloys:				
Scrap	6,303	7,598	--	Denmark 5,966; Sweden 1,268; West Germany 361.
Unwrought	36	254	--	Denmark 82; United Kingdom 67; Sweden 54; West Germany 41.
Semimanufactures	11	--		
Magnesium metal including alloys:				
Unwrought value, thousands	r$72,913	$90,224	NA	NA.
Wrought	70	173	--	West Germany 159.
Manganese ore and concentrate	--	1,287	--	All to United Kingdom.
Nickel:				
Ore and concentrate	12,212	12,692	--	All to Finland.
Metal including alloys:				
Scrap	562	994	25	Netherlands 912.
Unwrought	40,854	33,088	13,247	West Germany 5,691; United Kingdom 3,248; Japan 2,850.
Semimanufactures	5	12	NA	Denmark 5; Sweden 4.
Platinum-group metals and silver:				
Waste and sweepings kilograms	36,446	46,286	NA	West Germany 35,489; United Kingdom 6,972.
Metals including alloys:				
Platinum-group troy ounces	33,630	37,327	29,417	Netherlands 3,601; United Kingdom 2,476.
Silver do	773,771	749,304	NA	Sweden 536,306; United Kingdom 102,689.
Rare-earth metals, oxides	12	19	8	United Kingdom 5; Japan 5.
Silicon, elemental	63,006	56,165	2,051	U.S.S.R. 19,169; West Germany 11,922; United Kingdom 9,760.
Tin metal including alloys:				
Scrap	48	35	--	United Kingdom 14; West Germany 14; Denmark 7.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Tin metal including alloys —Continued				
Unwrought	59	21	--	Denmark 9; Sweden 9; Finland 3.
Semimanufactures	3	1	NA	NA.
Titanium:				
Ore and concentrate (ilmenite)	714,108	741,430	NA	NA.
Oxides	1,133	1,227	--	Sweden 1,003; Denmark 136.
Tungsten metal including alloys, all forms value	$6,867	$13,428	--	All to Sweden.
Zinc:				
Ore and concentrate	12,242	13,241	--	Poland 6,992; West Germany 6,249.
Oxide	455	671	NA	Sweden 340; Denmark 322.
Metal including alloys:				
Scrap	871	1,089	NA	West Germany 484; Belgium-Luxembourg 245; Sweden 172.
Blue powder	4,599	4,443	NA	NA.
Unwrought	57,029	61,933	NA	Sweden 18,106; United Kingdom 16,141; Denmark 5,875.
Semimanufactures	5,026	4,847	NA	NA.
Other:				
Ash and residue containing nonferrous metals	124,321	117,431	NA	West Germany 67,943; United Kingdom 28,072; Denmark 10,659.
Metalloids, n.e.s	7	7	--	United Kingdom 6.
NONMETALS				
Abrasives: Grinding and polishing wheels and stones	754	867	12	Sweden 190; Poland 166; Finland 126.
Asbestos	9	NA		
Barite and witherite	4,627	1,627	NA	United Kingdom 1,535; Sweden 71.
Cement, hydraulic thousand tons	607	694	259	Ghana 166; Liberia 138; Venezuela 89.
Chalk	4	7	NA	NA.
Clays and clay products (including all refractory brick):				
Crude	r77	286	NA	United Kingdom 131; Denmark 54; West Germany 50.
Products:				
Refractory (including nonclay brick)	3,719	4,576	NA	West Germany 2,481; Sweden 846; United Arab Emirates 187.
Nonrefractory value, thousands	r$1,988	$2,391	NA	West Germany $2,061.
Diamond, gem, not set or strung do.	$164	$334	NA	United Kingdom $177; West Germany $70.
Diatomite and other infusorial earth	45	34	NA	NA.
Feldspar and related materials	312,715	327,434	219	West Germany 75,778; United Kingdom 69,743; Netherlands 60,998.
Fertilizer materials:				
Manufactured:				
Nitrogenous value, thousands	$69,259	$82,006	NA	NA.
Phosphatic	2	1	NA	NA.
Potassic	3,678	30	NA	NA.
Other including mixed value, thousands	$106,003	$122,690	NA	NA.
Ammonia do.	$10,338	$2,625	NA	NA.
Graphite, natural	10,870	11,178	NA	NA.
Gypsum and plasters	693	9	NA	NA.
Lime	222	2,405	--	Sweden 1,285; Denmark 1,115.
Mica, crude, including splittings and waste	2,688	2,915	NA	West Germany 559; Netherlands 504; Portugal 331.
Pigments, mineral: Processed iron oxides	102	36	NA	Libya 12.
Precious and semiprecious stones except diamond value, thousands	$2	$51	NA	West Germany $39.
Pyrite, gross weight	63,139	27,256	NA	Sweden 26,250.
Salt	1,863	1,594	NA	Sweden 1,145; Denmark 200.
Sodium and potassium compounds, n.e.s value, thousands	$1,697	$6,881	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Marble and other calcareous stone	1,380	1,232	NA	Italy 698; Japan 299; West Germany 111.
Slate	46,822	39,897	NA	Netherlands 23,219; West Germany 6,777; Denmark 3,266.
Other	95,410	84,765	367	France 29,101; Italy 21,392; West Germany 21,133.
Worked, all types	234	312	NA	Sweden 190; Saudi Arabia 87.
Dolomite	115,250	111,728	NA	NA.

See footnotes at end of table.

Table 2.—Norway: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Gravel and crushed rock thousand tons	1,604	2,182	NA	West Germany 1,129; Denmark 367; United Kingdom 236.
Limestone except dimension	42,999	45,193	--	Denmark 37,173; United Kingdom 3,460; Ghana 2,500.
Quartz and quartzite	2,408	42,357	NA	Iceland 35,523; Switzerland 2,856.
Sand excluding metal-bearing	4,364	4,308	NA	United Arab Emirates 1,760; United Kingdom 125.
Sulfur:				
Elemental	2,298	3,283	--	Denmark 1,561; United Kingdom 1,020; West Germany 702.
Sulfuric acid value, thousands	$2,802	$2,562	NA	NA.
Talc, steatite, soapstone, pyrophyllite	59,166	52,007	NA	United Kingdom 14,312; West Germany 9,609; Sweden 7,311.
Other:				
Crude	16	NA		
Slag, dross, and similar waste, not metal-bearing	1,973	14,174	NA	Sweden 6,158; United Kingdom 2,879; West Germany 2,015.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	4,380	951	NA	Sweden 727; Denmark 110.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,423	9	NA	NA.
Carbon black	11	17	NA	NA.
Coal and coke including briquets:				
Anthracite and bituminous coal	77,042	63,577	--	West Germany 60,534; Taiwan 1,200; Denmark 1,063.
Coke and semicoke	105,764	55,145	--	Venezuela 17,534; Iceland 14,910; Sweden 13,862.
Gas, hydrocarbon, natural million cubic feet	504,369	734,102	--	West Germany 441,582; United Kingdom 292,520.
Peat, including peat litter	1	14	NA	NA.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	124,205	139,283	--	All to United Kingdom.
Refinery products:				
Gasoline including natural do	3,600	5,450	--	United Kingdom 1,966; Sweden 1,529; Netherlands 1,067.
Kerosine and jet fuel do	216	121	--	Sweden 108; Denmark 10.
Distillate fuel oil do	6,541	5,870	--	Sweden 2,391; Denmark 2,351; United Kingdom 763.
Residual fuel oil do	3,109	4,515	--	United Kingdom 1,767; Sweden 1,621; Denmark 637.
Lubricants do	5	3	--	Sweden 2.
Other:				
Mineral jelly and wax do	6	11	--	Mainly to Sweden.
Liquefied petroleum gas do	249	530	131	Sweden 195; Denmark 101; United Kingdom 64.
Nonlubricating oils, n.e.s. do	10	9	--	Sweden 6; Finland 1.
Petroleum coke do	762	1,037	75	Netherlands 456; France 184; U.S.S.R. 99; Italy 90.
Unspecified do	(1)	(1)	NA	NA.
Total do	14,498	17,546		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	32,399	49,703	--	Netherlands 30,063; Denmark 9,424; West Germany 5,556.

rRevised. NA Not available.
1Less than 1/2 unit.

Table 3.—Norway: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	3,706	20,641	--	Greece 16,735; West Germany 2,450; Sweden 1,455.
Alumina thousand tons	1,229	1,206	251	Suriname 311; Australia 293.
Metal including alloys:				
Scrap	355	124	--	Denmark 57; Finland 30; Sweden 24.
Unwrought	7,949	8,901	57	Sweden 4,198; West Germany 2,070; United Kingdom 1,674.
Semimanufactures	39,720	36,244	317	West Germany 17,306; Sweden 6,581; Belgium-Luxembourg 2,587.
Antimony metal including alloys, all forms	22	28	NA	United Kingdom 11; China, mainland 10.
Chromium:				
Chromite	5,372	36,357	--	India 28,079; Albania 7,689.
Oxide and hydroxide	258	299	NA	U.S.S.R. 200; West Germany 73.
Cobalt:				
Oxide and hydroxide	9	9	--	All from Belgium-Luxembourg.
Metal including alloys, all forms	3	18	--	Belgium-Luxembourg 16; West Germany 2.
Copper:				
Oxide and hydroxide	562	390	--	West Germany 285; Finland 100.
Copper sulfate	1,451	1,304	50	U.S.S.R. 500; Belgium-Luxembourg 409; Czechoslovakia 240.
Metal including alloys:				
Scrap	414	228	35	Denmark 113; Sweden 40.
Unwrought	3,920	2,633	--	Sweden 1,194; United Kingdom 562; Belgium-Luxembourg 561.
Semimanufactures	25,623	27,012	70	Sweden 10,054; West Germany 7,995; United Kingdom 2,758.
Gold metal, unworked or partly worked troy ounces	38,388	39,063	4,565	United Kingdom 16,976; West Germany 9,420.
Iron and steel:				
Ore and concentrate	121,106	312,434	--	Sweden 266,765; U.S.S.R. 45,669.
Metal including alloys:				
Scrap	10,064	6,418	NA	Denmark 2,725; Sweden 2,152; United Kingdom 1,175.
Pig iron, ferroalloys, similar materials	11,891	15,220	73	Sweden 5,388; West Germany 5,319; Canada 1,630.
Steel, primary forms	122,572	136,560	--	Netherlands 98,596; West Germany 18,344; Sweden 6,454.
Semimanufactures:				
Bars, rods, angles, shapes, sections	255,082	263,136	2	Sweden 63,800; West Germany 52,508; United Kingdom 42,356.
Universals, plates, sheets	504,731	430,828	1	West Germany 89,619; Sweden 60,899; Belgium-Luxembourg 58,704.
Hoop and strip	27,947	32,945	59	West Germany 8,565; Sweden 6,362; Belgium-Luxembourg 4,750.
Rails and accessories	23,315	23,640	NA	Sweden 20,174; West Germany 2,481.
Wire	14,701	15,582	154	Belgium-Luxembourg 6,653; Sweden 4,783; West Germany 1,340.
Tubes, pipes, fittings	129,532	144,142	818	West Germany 60,532; France 17,807; United Kingdom 15,973.
Total	955,308	910,273		
Lead:				
Oxides	742	738	7	United Kingdom 297; West Germany 270; Sweden 144.
Metal including alloys:				
Scrap	36	3	NA	NA.
Unwrought	13,178	12,102	7	United Kingdom 5,634; Denmark 3,091; Sweden 3,065.
Semimanufactures	1,291	1,069	1	Netherlands 591; Belgium-Luxembourg 136; West Germany 126.
Magnesium metal including alloys:				
Unwrought	1,099	386	271	Denmark 73; Iceland 23.
Wrought	41	26	NA	United Kingdom 6; Austria 3.
Manganese:				
Ore and concentrate	803,130	815,148	--	Republic of South Africa 276,640; Gabon 242,437; Brazil 163,272.
Oxides	316	411	NA	Netherlands 297; Belgium-Luxembourg 51; United Kingdom 42.
Metal including alloys, all forms	1,205	1,173	200	Republic of South Africa 939; West Germany 28.
Mercury 76-pound flasks	29	29	NA	NA.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Molybdenum metal including alloys, all forms	1	3	NA	NA.
Nickel:				
Matte, speiss, similar materials	54,429	78,897	--	Canada 64,368; United Kingdom 4,514; Netherlands 2,579.
Metal including alloys:				
Unwrought	638	86	26	United Kingdom 27; Canada 23.
Semimanufactures	191	197	14	West Germany 78; United Kingdom 56; Sweden 29.
Platinum-group metals and silver:				
Waste and sweepings kilograms	14,949	11,478	--	Sweden 7,846; Denmark 2,362; Finland 605.
Metals including alloys:				
Platinum-group troy ounces	12,796	6,848	--	United Kingdom 3,665; Switzerland 1,833.
Silver thousand troy ounces	3,531	2,697	NA	West Germany 1,208; United Kingdom 1,205.
Tin metal including alloys:				
Scrap	4	8	--	All from Sweden.
Unwrought	644	583	--	United Kingdom 363; Denmark 89; Netherlands 85.
Semimanufactures	234	280	NA	United Kingdom 145; Denmark 69.
Titanium:				
Ore and concentrate	176	228	--	All from Australia.
Oxide	519	1,300	28	West Germany 1,238; United Kingdom 23; France 9.
Tungsten metal including alloys, all forms	2	3	--	West Germany 2.
Uranium and thorium oxides including rare-earth oxides	125	72	20	Malaysia 20; West Germany 16; Japan 10.
Zinc:				
Ore and concentrate	74,386	73,102	--	All from Sweden.
Oxide and pentoxide	2,218	2,564	--	West Germany 1,975; East Germany 280.
Metal including alloys:				
Scrap	1,713	2,629	89	Sweden 1,458; Denmark 976.
Blue powder	115	3	NA	NA.
Unwrought	733	884	NA	United Kingdom 452; Poland 400; Sweden 25.
Semimanufactures	882	781	NA	France 454; West Germany 94; United Kingdom 63.
Other:				
Ores and concentrates	373	530	NA	Australia 500.
Ash and residue containing nonferrous metals	36,588	21,226	NA	Sweden 19,929; Denmark 1,174.
Metals including alloys, all forms:				
Metalloids	20	8	NA	NA.
Alkali, alkaline earth, rare-earth metals	302	267	55	Brazil 86; West Germany 47; Japan 35; United Kingdom 27.
NONMETALS				
Abrasives:				
Pumice, emery, natural corundum	14,273	6,972	101	Netherlands 3,224; West Germany 2,471; Iceland 1,000.
Dust and powder of natural or synthetic precious or semiprecious stones except diamond kilograms	15	75	NA	Netherlands 58.
Grinding and polishing wheels and stones	890	948	131	Austria 262; Sweden 165; West Germany 157.
Asbestos	517	490	33	West Germany 355; Finland 40; U.S.S.R. 20.
Barite and witherite	63,204	102,981	NA	Morocco 46,297; United Kingdom 22,192; Ireland 16,512.
Boron materials:				
Crude natural borates	7,118	7,275	6,072	Turkey 1,000; West Germany 202.
Oxide and acid	376	380	142	France 231.
Cement, hydraulic	6,011	8,055	NA	Finland 3,571; Denmark 2,118; United Kingdom 1,368.
Chalk	9,519	9,121	23	Denmark 5,035; Sweden 3,144; France 415.
Clays and clay products:				
Crude:				
Fuller's earth, Dinas, chamotte	910	112	NA	United Kingdom 59; West Germany 46.
Kaolin	79,369	83,765	624	United Kingdom 78,731; Czechoslovakia 3,368; West Germany 996.
Other	1,538	1,127	12	United Kingdom 786; Republic of South Africa 158.
Products:				
Refractory	15,605	19,397	94	United Kingdom 5,895; West Germany 3,800; Sweden 3,218.
Nonrefractory value, thousands	$10,487	$12,015	NA	West Germany $3,372; Sweden $1,778; Italy $1,422.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Cryolite and chiolite	4,566	5,746	--	Denmark 5,496; United Kingdom 250.
Diamond, gem, not set or strung thousand carats	40	65	NA	Sweden 30; United Kingdom 10; West Germany 10.
Diatomite and other infusorial earth	1,960	1,968	518	Iceland 784; Sweden 222; Denmark 182.
Feldspar	--	22	NA	NA.
Fertilizer materials:				
Crude:				
Phosphatic	419,329	427,397	107,501	Israel 108,004; Togo 101,025; Sweden 49,655.
Potassic	40	--		
Manufactured:				
Nitrogenous	6,276	1,109	NA	Czechoslovakia 380; West Germany 329; Ireland 209.
Phosphatic	5,917	5,772	NA	Sweden 5,130; Finland 540.
Potassic	268,629	302,590	5,824	Spain 79,824; France 59,831; United Kingdom 42,316; Belgium-Luxembourg 41,611.
Other including mixed	7,427	7,349	NA	Sweden 5,332; Netherlands 1,122.
Ammonia	18,257	84,097	43,017	U.S.S.R. 15,615; Venezuela 14,421; France 11,039.
Fluorspar	44,972	46,941	--	Morocco 16,131; East Germany 12,537; United Kingdom 4,952.
Graphite, natural	664	784	--	Sweden 467; United Kingdom 259; West Germany 57.
Gypsum and plasters	144,362	177,962	NA	Spain 121,885; France 41,129; Sweden 7,795.
Lime	10,171	7,966	NA	Denmark 5,852; Sweden 1,893.
Magnesite	2,662	6,030	12	Austria 2,356; North Korea 1,666; Czechoslovakia 1,017.
Mica, worked and unworked, all forms	2,071	2,160	55	India 1,865; Austria 104; United Kingdom 39; Switzerland 37.
Pigments, mineral: Processed iron oxides	2,487	2,861	20	West Germany 2,590; Sweden 182.
Precious and semiprecious stones, except diamond, including synthetic stones kilograms	7,221	14,170	791	Republic of South Africa 6,445; Brazil 3,274; United Kingdom 492.
Salt and brine	340,717	455,230	1	Netherlands 308,423; Spain 56,615; West Germany 29,548.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	28,325	6,064	--	Belgium-Luxembourg 2,660; Netherlands 1,998; United Kingdom 1,001.
Caustic potash and sodic and potassic peroxides	2,964	1,710	NA	Sweden 1,412; Belgium-Luxembourg 121.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	468	812	NA	Sweden 648; Portugal 61.
Slate	1,423	2,574	NA	Sweden 2,049; East Germany 235; China, mainland 205.
Other	4,503	12,155	NA	Portugal 6,761; Sweden 1,874; Poland 1,422.
Worked, all types	6,442	3,665	NA	Sweden 1,619; Italy 650; Denmark 343.
Dolomite	3,774	5,082	NA	United Kingdom 4,004; West Germany 483.
Flint	459	607	NA	Denmark 339; United Kingdom 118.
Gravel and crushed rock	68,184	74,986	NA	Sweden 73,676; Denmark 375.
Limestone	185,193	202,649	NA	United Kingdom 191,483; Denmark 7,898.
Quartz and quartzite	291,414	399,052	NA	Spain 295,997; Sweden 87,892.
Sand excluding metal-bearing	195,457	208,684	48	Belgium-Luxembourg 124,857; Sweden 62,907.
Sulfur:				
Elemental	15,533	2,607	NA	Sweden 2,112; West Germany 208; Turkey 200.
Sulfuric acid	274	1,604	NA	West Germany 1,415; Denmark 125.
Talc, steatite, soapstone, pyrophyllite	3,419	6,654	NA	India 3,800; Finland 2,001; China, mainland 257.
Other:				
Crude	78,224	100,503	282	West Germany 94,219; Netherlands 2,860.
Slag, dross, and similar waste, not metal bearing	r69,631	58,709	NA	Sweden 30,571; West Germany 9,183; Greece 6,760.
Oxides and hydroxides of magnesium, strontium, barium	332	316	9	France 145; West Germany 44; East Germany 41.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	8,452	5,113	17	Denmark 1,809; Finland 1,205; Sweden 791.

See footnotes at end of table.

Table 3.—Norway: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	109	110	100	NA.
Carbon black	4,113	4,590	111	Sweden 3,112; West Germany 1,037.
Coal, all grades, including briquets	447,489	672,375	125,565	Poland 345,532; United Kingdom 77,800; France 60,519.
Coke and semicoke	469,558	629,782	--	United Kingdom 379,378; West Germany 100,281; France 89,625.
Gas, hydrocarbon, natural cubic feet	1,483	2,401	NA	NA.
Peat, including peat briquets and litter	11,229	12,469	--	Sweden 10,601; U.S.S.R. 1,754.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	61,563	55,699	--	United Kingdom 28,097; Oman 6,389; Saudi Arabia 5,968; U.S.S.R. 5,081.
Refinery products:				
Gasoline, including natural do	4,115	5,072	(1)	Netherlands 1,295; Sweden 1,074; Belgium-Luxembourg 974.
Kerosine and jet fuel do	3,114	3,232	--	Belgium-Luxembourg 802; Netherlands 662; Libya 631; Algeria 445.
Distillate fuel oil do	6,839	8,043	33	Belgium-Luxembourg 2,394; Sweden 1,342; United Kingdom 905; Netherlands 678.
Residual fuel oil do	1,193	3,196	249	United Kingdom 778; U.S.S.R. 497; Libya 434; Sweden 371.
Lubricants do	541	517	29	Sweden 146; Denmark 133; United Kingdom 119; Belgium-Luxembourg 46.
Other:				
Mineral jelly and wax do	91	120	(1)	West Germany 69; United Kingdom 24.
Liquefied petroleum gas do	3,771	8,306	NA	NA.
Nonlubricating oils, n.e.s. do	47	98	2	France 46; United Kingdom 22; Belgium-Luxembourg 10.
Bitumen and other residues do	908	886	--	Netherlands 384; Denmark 193; Sweden 191.
Bituminous mixtures, n.e.s. do	16	15	1	United Kingdom 4; Denmark 3; Sweden 2.
Petroleum coke do	1,898	1,898	1,731	United Kingdom 117.
Pitch and pitch coke do	519	576	--	West Germany 287; United Kingdom 277.
Total do	r23,052	31,959		
Mineral tar and other coal-, petroleum-, or gas derived crude chemicals	r24,732	27,988	--	United Kingdom 11,174; Denmark 10,666.

rRevised. NA Not available.
1Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—In 1980, Norway's primary aluminum capacity was approximately 700,000 tons per year, making it the world's sixth largest producer. Almost 90% of the primary metal produced was exported, mainly to the European Economic Community (EEC), other Scandinavian countries, and to the United States.

Release of the Government's Energy White Paper (No. 54) aroused controversy with the aluminum industry. The paper laid down guidelines to the Storting (Parliament) for raising the price of electric power to more nearly reflect the replacement cost and to allocate consumption. The industry felt higher power prices would make production of the metal insufficiently profitable, while keeping production from reaching the market's potential. Electric power consumption by the industry was about 12 billion kilowatt-hours per year.

Major events in the aluminum industry in 1980 were: Aardal og Sunndal Verk AS (ASV group) commissioned a hydroelectric powerplant in the Gautingsdal Valley near Höyanger, near the west coast, which will supply the aluminum industry about 270 Gigawatt hours per year. Modernization of

the ASV group's Höyanger smelter continued, with expansion of its capacity from 30,000 to 75,000 tons per year. Completion was expected in 1981. Norsk Hydro AS and Alusuisse Norge AS have agreed to expand Norsk Hydro's ownership of Sör-Norge Aluminium AS from 19.5% to 40%. Alusuisse has a controlling interest in Sör-Norge.

The ASV group decided to increase the capacity of its Karmöy reduction plant, located on the west coast, from 110,000 to 160,000 tons per year. No date for completion was given.

Discussions have started between the Ministry of Industry, DNN Aluminium AS, and the ASV group on the planning of the Government-approved expansion of an existing reduction plant at the same location. The increase will be from 18,500 to 60,000 tons per year.

According to the ASV group, Norwegian producers of primary aluminum were as follows:

Company and facilities	Ownership	Products (domestic)	Capacity (tons)
Aardal og Sunndal Verk AS (ASV group) (Aardal, Höyanger, Sunndal).	Norwegian State 100%	Primary	330,000
		Semis	70,000
Mosal Aluminium AS (Mosjöem and Lista).	Elkem 55%, Alcoa (U.S.A.) 45%	Primary	170,000
Norsk Hydro AS (Karmöy)	Norsk Hydro AS 100% (51% of Norsk Hydro AS is owned by the Norwegian State).	Primary	110,000
		Semis	50,000
Sör-Norge Aluminium AS (Husnes)	Swiss Aluminium Ltd. 74.8%; Sopindus SA, Luxembourg 5.2%; Norsk Hydro AS 19.5%; and other 0.5%.	Primary	68,000
DNN Aluminium AS (Tyssedal)	Norwegian State 100%	Primary	18,500

Copper, Lead, and Zinc.—In 1980, the Norwegian copper fund continued to operate with a trigger price of NKr11 per kilogram which had been in effect since 1978, when a lower price had caused the fund to be exhausted. Accordingly, the falling of copper prices on the London Metal Exchange (LME) by 10% below this value (NKr9.90), triggers the disbursement of the difference from the fund to the mining companies, while the rise of the LME price by 10% above the trigger results in the companies transferring the difference into the fund. Transfers into or out of the fund are made in February or March of each year.

In the fall of 1980, the eight copper mining companies that participated in the copper fund proposed to the Government to raise the lower threshold from 10% to 5% below trigger price of NKr11 (from NKr9.90 to NKr10.45), starting with operations in 1981. Following Government-industry discussions, the proposal was expected to be ratified by the Norwegian Parliament.

Norway continued to be a moderate producer of complex sulfide ores, with independent companies operating nine nonferrous ore mines and employing about 530 people. Technically detailed descriptions of the mines and beneficiating plants appeared in 1980 in the professional literature.[3]

Iron and Steel, Ferroalloys.—Norway has expressed to the EEC displeasure at proposals for concluding a new trade agreement to restrict steel imports to the EEC. While willing to negotiate a new bilateral agreement, Norway recalled that it was one of the few European steel markets that were expanding, while the EEC demand is expected to drop during the lifetime of the proposed new trade agreement. In 1979, Norway imported about 700,000 tons of steel from the EEC, while exporting 440,000 tons of steel products of a different kind to the nine EEC countries. In case of a 10% reduction of Norway's exports to the EEC, as sought by the EEC, Norsk Jernverk is closing its steel plants, laying off several hundred workers by yearend at its Mo-i-Rana west coast steel plant.

In the meantime, AS Sydvaranger was preparing to lay off its entire work force of 1,200 persons at its Kirkenes iron ore mine in northern Norway from November 1 until further notice, because of full stockyards and falling demand for iron ore pellets. In Emden, Federal Republic of Germany, construction work neared completion at Nordeutsche Ferrowerke GmbH. This plant, a joint venture of AS Sydvaranger and Korf Stahl, is to use Norwegian natural gas for the direct-reduction of Scandinavian ore pellets.

In 1980, Norway's three largest iron ore mines were Government owned: AS Sydvaranger's Sör Varanger Mine near Kirkenes (capacity 2.3 million tons of concentrate per

year); Norsk Jernverk's Rana Gruber Mine near Mo (1.2 million tons); and Fosdalens Bergverks AS's Verran Mine in Nord-Trondelag (510,000 tons). Privately owned AS Rödsand Gruber was located near the west coast (150,000 tons). Minor quantities of iron ore were also produced as a byproduct of ilmenite mining at Titania AS's Sokndal Mine in south Norway, and at Elkem Spigerverket's vanadium production at Nesset on the west coast of Molde.

In 1980, Norway's ferroalloy industry held the strongest position in the world market. At the 1979 level, ferrosilicon capacity was about 300,000 tons per year (about 15% of world capacity); ferromanganese exports reached 293,000 tons; silicomanganese reached 171,000 tons; and other metallic-silicides production capacity totaled about 65,000 tons per year, also about 15% of world capacity. Norway's ferroalloy companies are shown in the following tabulation:

Company, ownership	Plant location
Elkem Spigerverket	Salten Verk, Fauske; Bremanger Verk, Svelgen; Fiskaa Verk, Kristiansand.
Fesil Nord (38% Elkem)	Sales organization of the Fesil group.
Icelandic Alloys (45% Elkem)	Straumsvik smelter, Iceland.
Tinfos Jernverk (member of Fesil group)	Tinfos Jernverk, Notodden; Oye Smelterverk, Kvinesdal.
Ila & Lilleby Smelterverker AS (member of Fesil group)	Lylleby Smelterverker, Trondheim; Holla Verk Kyrksaeterora.
Union Carbide Corp	Sauda Smelterverk AS Sauda; AS Meraker Smelterverk, Meraker (also 7 ferroalloy plants in the United States and Canada).
AS Hafslund (Fesil group) (also coowner of AS Björlvefossen)	Skeberg smelter, Ostfold.
AS Björlvefossen	Alvik Smelter, Hardanger.

By yearend, Elkem Spigerverket AS, already one of the world's largest producers of ferrosilicon, ferromanganese, ferrovanadium, and silicon metal, was buying Union Carbide ferroalloy facilities at 10 locations in Canada, the United States, Norway, and the United Kingdom for about $205 million, with annual capacity of about 600 thousand tons of manganese alloy and 450 thousand tons of silicon alloy. Elkem formed a consortium for the deal, holding a 40% share, while Shieldings Investments of Canada, a major Canadian investment banker, held another 40% and a group of Norwegian investors held 20%. Elkem was to be the operator.

Magnesium.—Although at present, the output of Norsk Hydro AS magnesium plant at Porksgrunn, south of Oslo, is in the 50,000-ton-per-year range, recent modernization of the process enables the plant to increase production up to 75,000 tons per year. The Porksgrunn plant, the only one in Norway, supplies about 20% of the Western World's magnesium.

A description of the metallurgical process used at Porksgrunn appeared in the technical literature.[4]

Nickel, Cobalt, Platinum-Group Metals.—Titania AS's Sokndal Mine, on the south coast, produced a concentrate byproduct with about 3.9% nickel content. This ore, plus imported nickel matte from Canada containing cobalt and platinum, was processed at Falconbridge Nikkelverk AS's Kristiansand refinery on the south coast.

Rare-Earth Metals.—Surface studies made in the Fens Field at Ulefoss in Telemark County have indicated a considerable rare-earth deposit—containing cerium, yttrium, europium, gadolinium, and thorium—set aside for drilling in the summer of 1981. The operator was a company called Fenco, established for this purpose by S.D. Cappelen, together with Aardal og Sunndal Verk AS, Elkem Spigerverket AS, AS Sydvaranger, and the U.S. concern Union Mineral Norway, a subsidiary of the Union Oil Co.

NONMETALS

Cement.—Plans for a new cement plant in Tromsdalen, near Tromsö, where plentiful reserves of industrial limestone were available, were canceled by Norcem, Norway's only cement concern. In 1980, the company operated three cement plants, totaling 3.2 million tons of capacity.

Fertilizer Materials.—In 1980, Norsk Hydro AS purchased the Nederlandse Stikstof Maatschapij. Norsk Hydro thereby became the world's largest exporter of urea, and was said to be the world's third or fourth largest producer of fertilizer materials. The sharp increase in raw material costs in 1980 put the ammonia plants at Porksgrunn,

which use heavy oil, naphtha or natural gas liquids, at a disadvantage compared with competitors using natural gas as a feedstock and fuel. The company was therefore considering establishing new ammonia capacity based on natural gas. The plant location had not yet been chosen.

Graphite.—In 1980, the only Norwegian graphite producer was AS Skaaland Grafitverk, a subsidiary of Ever Ready Holdings (U.K.) Ltd., also known as the Berec group, and an associate of the U.K.-based Chemical and Carbon Products Ltd. Skaaland mines, a crystalline flake deposit on Senja Island, in the far north, just south of Tromsö, was established in 1931. Reserves of over 1 million tons of ore which contain 25% to 30% carbon are said to be available. About 40,000 tons per year of ore were being mined, and a 88% to 90% concentrate was obtained. The beneficiation plant was expanded recently.

Industrial Minerals.—A number of industrial minerals continued to be produced in Norway. AS Sydvaranger had started a quartzite mine near Tana, west of Kirkenes. The quartzite was shipped to Iceland and used by Icelandic Alloys Ltd., partly owned by Elkem Spigerverket AS. There were experiments to produce an oil-drilling mud compound from the heavy components of ilmenite concentrates of Titania AS. Norsk Nefelin AS, a subsidiary of Elkem Spigerverket AS, produced nepheline syenite of various grades. Norfloat AS, a subsidiary of the H. Björum group companies, continued production of potassium and sodium feldspar and quartz concentrates from pegmatites in southern Norway.

Olivine.—In 1980, AS Olivin was the world's largest producer of olivine, from a mine located at Aaheim in the Sunmore district of western Norway. The company's production in 1980 was expected to reach about 1 million tons, 80% of which was for export. According to estimates, about 750,000 tons were sold to smelters for slag-conditioning purposes in 1980. Both wet and dry processing were used to produce a wide range of products including olivine flour. The Federal Republic of Germany and France purchased a total of about 500,000 tons in 1980, and Belgium, Finland, the United Kingdom, and the Netherlands were also important customers. The Aaheim plant also has a 50,000-ton-per-year facility for the production of olivine bricks, but this plant operated at a rate of only 18,000 tons per year as the demand for night storage heater blocks, the principal use for the bricks, had decreased. Blasting sand and molding sand were also among the company's products. Norway's second largest olivine producer was KS Norddal Olivin AS & Co., a member of the H. Björum group companies. Production in 1980 was expected to reach approximately 105,000 tons, and even more in 1981. Normally, the company produced 150,000 tons of olivine per year, but closing of the older Norddal Mine and development of the Lefdal Mine caused a temporary decrease in output. About 70 % of sales was said to be used as a slag conditioner.

Although AS Olivin and KS Norddal Olivin were Norway's only olivine producers in 1980, a third company was preparing to enter production. A consortium composed of Orkla Industrier AS, Sigval Bergsen D.Y., and Stokke Olivine AS undertook test drilling of olivine deposits around Robbervika in west Norway. The new company, temporarily called Industriterminaler AS, was not yet firmly committed to startup, because of softness in the olivine market.

Silicon Carbide.—In 1980, Norway had three producers of silicon carbide, with total capacity exceeding 70,000 tons per year. Arendal Smelterverk AS, a subsidiary of Carborundum Co. of the United States, operated a 42,000-ton-per-year plant in Arendal on the south coast. Norton AS, a subsidiary of the U.S. Norton Co. of the U.S.A. operated a 17,000-ton-per-year plant at Lillesand, also on the south coast. Orkla Exolon AS & Co., a company jointly owned by Orkla-Gruve AB, Elkem Spigerverket AS, and the Exolon Co., operated a 12,000-ton-per-year plant at Orkanger in the, north near Trondheim.

MINERAL FUELS

In 1980, Norway was well on its way to becoming a major oil exporter in Western Europe. Growing North Sea oil output exceeded home consumption more than six-fold, and accounted for a substantial foreign trade surplus. The country's gross energy consumption in 1980 was about 41% electric power, mostly hydroelectric, of which a small percent was imported from the U.S.S.R. through Kirkenes in the north; about 52% of consumption was hydrocarbons; and about 7% was coal, of which more than two-thirds was imported.

Coal.—The first sample load of coal from the new Svea Mine on Svalbard Island arrived in November 1980 at Norcem's cement plant in Dalen. In 1981, Svea coal is to be used on a regular basis. The coal is of

higher quality than the imported Polish coal used previously.

Hydroelectric Power.—Much of Norway's mineral industry owes its existence to abundant and inexpensive hydroelectric power. Virtually all of the 29.6 billion kilowatt-hours generated in the country came from hydroelectric power stations. In 1980, the Parliament approved the Government's plan for hydroelectric power development and pricing (White Paper No. 54). The plan called for steep increases in electricity prices to encourage efficient use and conservation. Prices were to be based on long-term marginal cost of new power. Development of new hydropower sources are to be a compromise between industrial and environmental needs. By 1990, two major hydroelectric plants are to be built, and existing ones will be expanded, with capacity thereby increased from 83 to 94 billion kilowatt-hours per year. About 75 waterways are to be excluded from development.

Petroleum and Natural Gas.—In 1981, oil and gas production in the Norwegian sector of the North Sea increased by approximately 25% to 49.5 million tons of oil equivalent. Of the total, about 24.4 million tons was oil and about 25.1 billion cubic meters was natural gas production. The main oilfields contributing to oil production in the North Sea were the Ekofisk Field, which produced 21.4 million tons of oil and 15.1 billion cubic meters of natural gas; the Frigg Field which produced 10 billion cubic meters of natural gas; the Statfjord Field, which produced about 2.8 million tons of oil (Norwegian share); and the Murchison Field, which produced 75,000 tons of oil (Norwegian share). Besides the producing oilfields, there was development work in the Valhall and Ula Fields, also in the North Sea.

There were negotiations between the United Kingdom and Norway, for the sale of Statfjord natural gas to the United Kingdom. Other negotiations centered around the sale of Ula natural gas to the Federal Republic of Germany.

Shell Oil Co.'s gas discovery in Block 3 1/2, made in 1978, was said to exceed in size the Groningen Field in the Netherlands, which is one of the largest in the world. Shell, the operator of the field, owns 35%, Statoil (the Norwegian Government Oil Co.) owns 50%, and Norsk Hydro AS, Conoco, and the Superior Oil Co. each own 5% of the equity. Reserves were said to exceed 1.5 trillion cubic meters of gas and unspecified quantities of oil.

Statoil discovered hydrocarbons in block 30/5, that was said to be substantial. Phillips cut its reserve estimate for the Ekofisk area to about 400 million tons of oil equivalent. Ekofisk and Statoil crude, of a particularly high quality, being light and low in sulfur, was priced by yearend in the range of $39.80 to $40.50 per barrel.

On March 27th, a five-legged floating rig, the *Alexander L. Kielland*, located near the Edda platform, which was used as a hotel, collapsed in a heavy storm. A total of 42 persons died, 81 were listed missing, and 89 survived. The accident was apparently caused by stress cracks and corrosion.

Drilling north of the 62d parallel started in the summer by Statoil in block 7119/12 of the Tromsö area, in 200 meters of water. Hydrocarbons were found in sandstones, but indications were not sufficient to judge their importance, and it was planned to sink the well further to 3,500 meters. Statoil owns 50% of the exploration group, Esso Exploration and Production Co. owns 25%, Norsk Hydro Produksjon owns 10%, and Saga Petroleum, Deminex, and Hispanoil owns 5% each.

A white paper issued by the Norwegian Government in 1980 reaffirmed the earlier decision to hold total oil and gas production to 90 million tons per year of oil equivalent. According to the report, new reserves discovered in both oilfields and gasfields make it possible that the limit will be exceeded if development of both hydrocarbons is now vigorously pursued, and the Government will thus be forced to choose to limit one or the other.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values in Norwegian kroner (NKr) have been converted to U.S. dollars at the rate of NKr5.00 = US$1.00 for 1980.

[3]Mining Magazine (London). November 1980, pp. 416, 427.

[4]Metal Bulletin Monthly (London). August 1980, pp. 25-26.

The Mineral Industry of Pakistan

By Suzann C. Ambrosio[1]

The mineral industry of Pakistan contributed less than 1% to the 1979-80[2] gross national product of approximately $23 billion[3] at current prices. The importance of fuel and nonfuel minerals was reflected in record Government budget allocations of approximately $75 million and $12 million, respectively. Although the public sector continued to dominate most of the mining industry, including iron and steel, fertilizers, cement, chemicals, petroleum, and natural gas, the Government decided to allow the private sector minority shareholdings in various industrial projects. The private sector has already been involved in fertilizer and cement industries on a small scale, and has been encouraged to initiate production of soda ash and other mineral-derived products.

Although moderate growth was achieved by most mineral producers, large advances occurred through the completion of various mineral projects, enhanced exploration efforts, and infrastructure development. Major accomplishments were made during 1980 in a variety of areas. The Saindak copper mine project advanced from feasibility status to the planning and design stages. The first blast furnace was "blown in" at the Pipri Steelworks near Karachi. Cement plant expansion projects were nearing completion, and additional plants were proposed to meet growing domestic demands. The National Fertilizer Corp.'s Mirpur Mathelo plant, a joint venture between Pakistan and Saudi Arabia, was brought online, and new fertilizer projects were planned. The Gudu thermal power station financed by the Soviet Union was completed. Various gas and oil pipeline projects made headway. The Adhi Oilfields were brought into production after overcoming persistent drilling problems. Expenditures made in the above areas were expected to generate significant returns through increased production and trade throughout the 1980's.

Intensive explorations were carried out on various oil and gas sites, and drilling activities were expected to double 1979 levels. Attention was also given to the relatively remote and unexplored North West Frontier Province (NWFP). Late in 1980, an "economic breakthrough" was reported in Kohistan, nestled in the high mountains of the Karakoram Range between Pakistan and mainland China. Vast deposits of major minerals were discovered, including iron minerals, and substantial quantities of chromite, copper, lead, and zinc ores. In addition, the Gemstone Corp. of Pakistan Ltd. started exploration in the Swat district of NWFP, for the purpose of locating new emerald deposits.

The Government initiated a number of mineral-based projects to meet the needs of Pakistan Steel Mill Corp. (PASMIC) and other mineral industries during the year. Port Qasim, which was built especially for the steel complex, was expected to be open to traffic early in 1981. The opening of Port Qasim was expected to alleviate the handling of iron ore and fertilizer imports, which were subject to extensive delays at the Port of Karachi. The Pipri Steelworks marshaling yard and other storage facilities were completed. The Government also granted nearly $3 million for the construction of numerous 13,000-ton-capacity fertilizer depots.

Pakistan's 1980 gross domestic product (GDP) measured in 1969-70 constant prices grew at a rate of 6.2% compared with 5.9% for 1979. The agricultural sector, representing 30% of the GDP, grew 40% during the

year primarily due to production increases in wheat, rice, and cotton crops. The net effect was an improvement in the balance of payments situation, as agricultural products accounted for one-third of all exports. Growth in the industrial sector, which comprised 14% of the GDP in 1980 was driven by an 8.1% increase in the manufacturing sector.

The 1980 Balance of Payments (BOP) deficit registered an improvement from $999 million to $752 million. Worker remittances climbed at a rate of 23% since 1979 and peaked at approximately $2 billion during 1980. Export income contributed significantly to the BOP primarily because of higher export unit values. Improvement in the BOP situation was expected if Pakistan's debts were rescheduled. The Government's external debts amounted to over $10 billion by yearend 1980. The International Monetary Fund (IMF) approved a 3-year loan of $1.7 billion to Pakistan in December 1980. The loan was targeted to reduce Pakistan's BOP deficit from 5% of the GDP to under 4% by 1983. The net inflow of foreign aid has declined since 1975, because of increasing debt service liability. In addition, the Soviet invasion of Afghanistan required additional military expenditures and refugee aid. The IMF and Aid to Pakistan Consortium were considering debt rescheduling in conjunction with strict budgetary controls. Declines in deficit financing and monetary expansions were expected to curb inflation, running at approximately 11% during 1980.

The Government of Pakistan initiated some fiscal policy changes during 1980. The overall goal was to increase self-sufficiency by expanding industrialization and exports and by limiting nondevelopment expenditures. Various tax incentives were geared to stimulate private industrial investment. The most significant move was the extension of the capital gains tax exemptions through 1982.

PRODUCTION

Mineral production continued to account for less than 1% of the nation's GDP during 1980. Mineral fuels continued to be the most valuable mineral commodity produced and exported. Natural gas provided approximately 90% of the industrial sector's energy requirements. Natural gas was distributed among fertilizer factories (28%); thermal power stations (19%); cement factories (11%); other industrial users, including iron, steel, and chemical producers (33%); domestic and commercial users (9%). Production of crude petroleum increased 5%, petroleum products increased 2%, and natural gas increased 11% between 1977 and 1979. These trends were expected to continue because exploration, production, and refinery capacities have all increased over the past year. Increased exploratory drillings and expansion wells were projected to be capable of tripling 1980 oil production levels to 36,000 barrels per day by 1984.

Production of other important nonfuel minerals grew moderately between 1978 and 1980. Fertilizer production has grown steadily: 1980 output increased 26% over the previous fiscal year. The largest gains were reported for ammonium nitrates and nitrophosphates. Output from the cement, chemical, and steel industries increased approximately 10% over 1979 levels. Commissioning of all the proposed fertilizer plant expansion and construction projects was expected to leave production short, necessitating imports of 123,000 tons in 1983.

Table 1.—Pakistan: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum: Bauxite, gross weight	124	151	1,621	1,640	[2]1,700
Antimony ore:					
Gross weight	55	94	104	31	40
Metal content[e]	11	19	21	[r]6	10
Chromium: Chromite, gross weight	10,872	8,400	11,000	2,638	[2]4,000
Iron and steel: Mild steel products thousand tons	243	277	349	[e]365	400
Manganese ore, gross weight	64	53	288	110	[2]175
NONMETALS					
Abrasives, natural: Emery	907	657	887	1,133	1,100
Barite	9,380	17,718	19,194	34,200	38,000
Cement, hydraulic thousand tons	3,138	3,165	3,103	3,418	[2]3,336
Chalk	1,376	1,105	1,091	1,595	1,500
Clays:					
Bentonite	747	1,089	906	1,441	1,400
Fire clay	28,019	53,100	50,000	56,168	58,000
Fuller's earth	16,000	18,000	18,000	40,331	[2]29,000
Kaolin (china clay)	346	566	13,758	15,114	16,000
Other	60,000	65,000	76,000	[e]70,000	70,000
Feldspar	2,705	3,699	14,305	14,851	15,000
Fluorspar	10	--	335	418	[2]1,100
Gypsum, crude	447,000	283,000	253,000	343,000	[2]362,000
Magnesite, crude	3,246	1,567	2,672	2,748	[2]1,525
Nitrogen: N content of ammonia	326,700	315,300	309,200	385,600	430,000
Pigments, mineral, natural: Ocher	15,795	14,310	4,672	1,028	4,000
Salt:					
Rock thousand tons	375	385	413	512	[2]495
Marine do.	144	114	227	192	200
Total do.	519	499	640	704	695
Sand and gravel:					
Gravel	46,000	40,000	96,000	83,000	90,000
Sand:					
Bajri and common	29,549	14,131	20,836	18,086	25,000
Glass	44,668	66,088	69,656	91,000	[2]104,000
Sodium compounds, n.e.s.:					
Caustic soda	30,660	25,914	34,605	37,831	40,000
Soda ash, manufactured	63,288	60,579	74,019	75,258	77,000
Stone:					
Aragonite and marble	29,000	34,000	39,000	102,000	90,000
Dolomite	1,162	2,723	11,426	13,904	[2]15,700
Limestone thousand tons	3,000	3,895	2,887	3,297	3,500
Crushed do.	1,740	693	172	1,445	1,500
Strontium minerals: Celestite	603	365	217	620	600
Sulfur:					
Native	1,326	1,160	1,083	729	700
Byproduct, all sources[e]	12,000	12,000	14,000	14,000	14,000
Total	13,326	13,160	15,083	14,729	14,700
Talc and related materials: Soapstone	5,035	9,179	25,290	27,200	30,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades thousand tons	1,349	1,154	1,036	1,329	[2]1,500
Gas, natural (sales) million cubic feet	183,635	180,324	195,784	240,033	280,000
Natural gas liquids[e] thousand 42-gallon barrels	32	32	36	38	40
Petroleum:					
Crude do.	2,562	3,720	3,491	3,823	[2]3,566
Refinery products:					
Gasoline do.	2,152	4,015	3,735	[e]3,900	4,000
Jet fuel do.	3,176	3,221	3,893	4,170	4,000
Kerosine do.	2,005	1,840	1,749	1,224	1,500
Distillate fuel oil do.	5,822	5,120	7,619	[e]7,800	8,000
Residual fuel oil do.	9,032	6,057	7,734	[e]7,000	7,000
Lubricants do.	501	609	616	[e]610	600
Other do.	1,420	926	9,392	[e]8,500	9,000
Refinery fuel and losses do.	834	2,057	2,000	[e]2,100	2,500
Total do.	24,942	23,845	36,738	35,304	36,600

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 10, 1981.

[2]Reported figure.

TRADE

Pakistan's trade gap continued to widen during 1980, despite record growth in exports and a decline in the growth of imports. Export revenues rose 38% over the previous fiscal year, reaching $2.3 billion. Imports rose 29% to $4.7 billion, resulting in a $2.4 billion trade deficit for 1980. The import bill for crude oil and refined products accounted for 30% of all imports and 50% of the total export earnings. Although Pakistan is an exporter of certain refined oil products, such as furnace oil and naphtha, approximately 22% of the country's refined oil products were imported.

Mineral trade constituted a significant portion of the trade deficit. Pakistan's most important mineral exports included refined petroleum products, barite, and some manufactured ferrous-metal products. Price increases of over 100% for crude oil and petroleum products and 34% for iron and steel materials were primarily responsible for large import expenditures between 1979 and 1980. The value and volume of chemical fertilizer imports, however, declined during the same period. Approximately 7 million tons of fertilizers were imported at an estimated cost of $400 million.

The restrictive import policy that was in effect at the end of 1979 was modified during April 1980. Relaxed import controls for industrial raw materials and spare parts included a 10% increase in import allowances over the previous base. The importer may select the base as either the value licensed in 1978-79, or the average value licensed over the past 3 fiscal years. Several specific import policy changes that concern the mineral industry were made. Steel producers may import sponge iron in lieu of iron and steel scrap; import licenses were declared eligible for unserviceable ships (used for iron and steel scrap); mineral imports such as mercury, aluminum, copper, zinc, and lead, previously limited to the public sector, were opened to the private sector; new items were added to the "free list," including various chemicals, nickel waste, copper powders, and flakes; authorization of machinery imports ($1 million maximum) was permitted for new investment projects (worth $2 million) without Government approval; and monetary ceilings were doubled to $10,100 for imported machinery parts and accessories.

Table 2.—Pakistan: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Chromium ore and concentrate	4,086	NA	NA.
Iron and steel semimanufactures: Bars, rods, angles, shapes, sections	--	715	All to Afghanistan.
Silver ores and concentrates[1] value, thousands	NA	$1,243	All to United Kingdom.
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	110	910	Italy 880.
Cement	--	49	NA.
Fertilizer materials, crude:			
Phosphatic	--	897	NA.
Other including mixed	--	135	NA.
Precious and semiprecious stones including diamond, natural and synthetic value, thousands	$489	$692	Switzerland $233; France $151; West Germany $142.
Salt	15,459	11,027	India 8,568.
Sodium compounds, n.e.s.: Soda ash	20	8	NA.
Stone:			
Crude:			
Onyx	12,475	26,479	Mainly to Italy.
Other	7,511	4,418	NA.
Worked, dimension	4,939	3,596	Italy 2,343; Japan 350; United Arab Emirates 102.
Other nonmetals, n.e.s.:			
Crude	6,072	3,903	United Arab Emirates 3,658.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals	56,333	1,634	Afghanistan 1,509.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	662	2,310	People's Democratic Republic of Yemen 609; Yemen Arab Republic 578; Iran 373.
Refinery products: Residual fuel oil do	3,327	5,090	India 1,678; United Arab Emirates 748; Turkey 666.

NA Not available.

[1]May contain ores and concentrates of platinum-group metals.

Table 3.—Pakistan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	398	1,123	NA	NA.
Metal including alloys:				
Waste and scrap	52,001	12,545	NA	NA.
Unwrought	4,523	3,800	--	Canada 1,615; U.S.S.R. 948; West Germany 909.
Semimanufactures	3,284	4,790	7	Canada 2,237; West Germany 595; Switzerland 384.
Arsenic oxides and acids	--	28	NA	NA.
Cobalt oxides and hydroxides	2	8	NA	NA.
Copper:				
Oxides	7	18	NA	NA.
Copper sulfate kilograms	995	--		
Metal including alloys:				
Waste and scrap	2,570	933	NA	NA.
Unwrought	794	593	--	West Germany 256; Canada 176; Japan 115.
Semimanufactures	3,448	3,653	55	West Germany 1,078; Japan 718; Poland 416.
Iron and steel metal:				
Scrap	187,111	139,225	7,766	United Arab Emirates 48,659; Kuwait 16,306; Oman 9,513.
Pig iron, cast iron, spiegeleisen	12,347	53,248	--	Australia 16,862; China, mainland 14,278; United Kingdom 11,108.
Ferroalloys:				
Ferromanganese	1,346	5,247	NA	Japan 2,554; Norway 2,008; Belgium-Luxembourg 307.
Other	2,046	3,131	NA	Norway 1,127; Republic of Korea 768; Japan 460.
Steel, primary forms	116,215	187,003	2,269	Japan 53,229; Netherlands 38,226; U.S.S.R. 15,997.
Semimanufactures:				
Bars, rods, angles, shapes, sections	38,113	43,111	197	Japan 21,502; West Germany 6,195; Czechoslovakia 3,953.
Universals, plates, sheets	236,135	396,403	118,883	Japan 94,912; West Germany 44,349; Australia 29,264.
Hoop and strip	5,242	5,380	NA	Japan 3,325; United Kingdom 859.
Rails and accessories	24,919	38,474	--	United Kingdom 17,681; Canada 13,367; Australia 5,230.
Wire	15,772	13,654	1,056	China, mainland 2,879; Romania 2,828; Japan 2,466.
Tubes, pipes, fittings	24,645	24,718	3,786	Japan 10,815; Italy 5,451; China, mainland 1,038.
Castings and forgings, rough	2,747	1,887	54	United Kingdom 1,300; Belgium-Luxembourg 150; Turkey 87.
Lead:				
Ore and concentrate	208	115	--	NA.
Oxides	5	6	NA	NA.
Metal including alloys:				
Waste and scrap	265	--		
Unwrought and semimanufactures	2,218	1,584	--	Canada 1,564.
Manganese oxides and hydroxides	388	746	NA	NA.
Mercury 76-pound flasks	1,108	773	NA	NA.
Nickel:				
Ore and concentrate value, thousands	--	$182	NA	Switzerland $136.
Metal including alloys:				
Waste and scrap	2	2	NA	NA.
Unwrought	56	61	--	Canada 36; United Kingdom 19.
Semimanufactures	164	224	NA	West Germany 163; United Kingdom 31.
Platinum-group metals including alloys, unwrought and wrought value, thousands	$144	--		
Silicon metal including alloys, all forms	6	40	NA	NA.
Tin metal including alloys:				
Waste and scrap	43	192	NA	NA.
Unwrought and semimanufactures	338	393	--	Malaysia 275; Canada 70.
Titanium oxides	911	1,135	NA	NA.
Zinc:				
Oxides	611	527	NA	NA.
Metal including alloys:				
Waste and scrap	80	--		
Blue powder	147	109	NA	NA.
Unwrought	9,274	5,534	--	Canada 1,934; Belgium-Luxembourg 1,885; Republic of Korea 775.
Semimanufactures	258	151	--	NA.
Other:				
Ash and residue containing nonferrous metals	80	34	NA	NA.
Oxides, n.e.s	4,818	5,388	NA	China, mainland 2,065; West Germany 1,132; Japan 616.

See footnotes at end of table.

Table 3.—Pakistan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Metals including alloys:				
Precious metals, unwrought or partly wrought, n.e.s. value, thousands	$38	--		
Base metals, unwrought and semimanufactures do	$373	$356	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	698	633	NA	Mainly from Netherlands.
Grinding and polishing wheels and stones	329	316	NA	West Germany 105.
Artificial corundum	2	--		
Asbestos	5,873	14,963	--	Canada 11,497; West Germany 1,809.
Boron materials: Oxide and acid	123	134	NA	NA.
Cement	175,697	685,849	NA	Republic of Korea 209,844; Romania 169,102; Japan 103,364.
Clays and clay products:				
Crude: Kaolin (china clay)	4,712	5,934	NA	NA.
Products:				
Refractory including nonclay brick	10,665	7,368	132	West Germany 1,955; United Kingdom 868; China, mainland 741.
Nonrefractory	235	1,009	--	Japan 309; United Kingdom 247; West Germany 220.
Diatomite	4	93	NA	NA.
Fertilizer materials:				
Crude:				
Nitrogenous	184,746	--		
Phosphatic	61,894	86,008	--	Jordan 85,985.
Other including mixed	--	63	NA	NA.
Manufactured:				
Nitrogenous	611,697	865,481	15,369	Iraq 109,500; Netherlands 105,241; Kuwait 80,700.
Phosphatic	588,966	451,287	127,308	Netherlands 180,191; Canada 76,742; France 34,100.
Potassic	4,181	29,088	--	West Germany 19,063; France 10,000.
Other including mixed	50,274	1,450	--	All from United Kingdom.
Ammonia	17	49	NA	NA.
Graphite, natural	979	612	NA	NA.
Pigments, mineral: Processed iron oxides	12	19	NA	NA.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	1,457	3,727	NA	NA.
Caustic potash	63	72	NA	NA.
Soda ash	665	1,003	NA	NA.
Stone: Dimension, worked	--	7,513	--	All from Bulgaria.
Sulfur:				
Elemental	8,361	15,504	NA	Iran 12,361; Kuwait 2,926.
Sulfur dioxide kilograms	--	354	NA	NA.
Sulfuric acid	8	12	NA	NA.
Other:				
Crude value, thousands	$1,080	$1,489	NA	Belgium-Luxembourg $569; Czechoslovakia $377; China, mainland $119.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals, n.e.s	2,546	3,064	NA	India 3,038.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	291	289	NA	NA.
Carbon black	1,678	2,114	NA	NA.
Coal, all grades, including briquets	16,057	317	NA	NA.
Coke and semicoke	56,132	41,995	--	West Germany 16,000; France 14,480; Italy 11,505.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	30,103	22,114	--	Saudi Arabia 12,827; United Arab Emirates 5,085; Iraq 3,893; Iran 309.
Refinery products:				
Gasoline do	512	675	--	Kuwait 555; Italy 66; Iran 38.
Kerosine and white spirit do	4,212	5,330	NA	Kuwait 5,173; Saudi Arabia 156.
Distillate fuel oil do	6,017	7,192	NA	Kuwait 7,166; United Arab Emirates 26.
Residual fuel oil do	127	127	36	Singapore 49; Japan 33; United Kingdom 6.
Lubricants do	326	364	188	Japan 113; Singapore 40; France 10.
Mineral jelly and wax do	44	73	NA	China, mainland 49; Japan 5; West Germany 4.
Other do	6	3	2	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	--	4,121	NA	United Kingdom 3,914.

NA Not available.

COMMODITY REVIEW

METALS

Bauxite.—General Refractories Ltd. constructed an alumina brick factory which was subsequently transferred and revised by the Industrial Development Board of Pakistan (IDBP) during the late 1970's. The refractory had an installed kiln capacity of 10,000 tons per year in 1980, and it produced high- and low-grade alumina bricks, insulated bricks, tiles, and mortar.

Chromite.—Chromite production significantly declined since 1978, due to the expensive transport costs from the chromite mines in Baluchistan to the Port of Karachi. The Pakistan Council for Scientific and Industrial Research (PCSIR) successfully raised the Cr_2O_3 content of low-grade chromite reserves from 25% to 48% at a pilot plant constructed during 1979. Chromite production was expected to feed two proposed refractory plants and to supply local chemical and metallurgical industries. The Pakistan Mineral Development Corp. (PMDC) proposed to locate the refractory manufacturing plants at Malakand in Baluchistan, and Hatar in NWFP. The Malakand plant was designed to produce 15,000 tons of magnesite and/or chromite bricks and 10,000 tons of dead-burned magnesite. Mainland China and the Pakistan Industrial Development Corp. (PIDC) were conducting geological surveys by yearend 1980. The Hatar refractory plant was still in the planning stage.

Copper.—Feasibility studies completed for the proposed Saindak Mine project delineated three porphyry copper deposits. Proven reserves located in the extreme northwest corner of Baluchistan were estimated to contain 412 million tons of copper ore, with an average grade of 0.37% copper. Pakistan's Resource Development Corp. (RDC) was negotiating a loan for $155 million with foreign firms and an equity share of 6.3%, for the $315 million Saindak project. Operations were projected to commence in 1982, with an annual production capacity of 17,000 tons of blister copper, 225,000 tons of sulfuric acid, 40,000 troy ounces of gold, 100,000 troy ounces of silver, and 140 tons of molybdenum.[4] Large infrastructure expenditures were required to achieve projected production levels and accessibility of the remote deposits.

Iron Ore.—Nine deposits were estimated to contain 500 million tons of iron ore in 1980. The bulk of the proven reserves equivalent to 335 million tons, were located within the Chichali deposits in Kalabagh, Punjab. Lack of financial support for the Chichali ores, with a low 32.5% metal content, has hindered further development. High-grade iron ore deposits with a 50% average metal content were discovered during 1979 in Pachinkoh and Chigendik, Baluchistan. Drilling studies have revealed proven reserves exceeding 13 million tons. PIDC's drilling program and comprehensive geological reports were expected to be complete by June 1981. Metallurgical studies conducted by PCSIR and the Japanese Consulting Institute have reported encouraging beneficiation results.

Iron and Steel.—Pakistan's iron and steel demand was approximately 1.5 million tons in 1980. Projected demand was estimated to increase 50% by 1987, when the Pipri steel mills were expected to achieve full production (1.15 million tons). PASMIC completed the steelworks at Pipri during 1980. Pig iron production was scheduled to commence in December 1980, with the commissioning of the first blast furnace. The steelmaking plant and 800-millimeter billet mills were expected to be operational in 1981. Pakistan signed import agreements with Liberia, Brazil, and India for 4.2 million tons of iron ore, during 1980. PASMIC was planning additional projects based on semimanufactured steel from the integrated steelworks.

Molybdenum.—Investigations of the Darbanchah molybdenum reserves in Baluchistan continued throughout 1980. Small amounts of molybdenum were expected to be recovered in 1982 when the Saindak project comes online.

NONMETALS

Barite.—Bolan Mining Enterprises Ltd. continued to increase the output of Khuzdar barites during 1980. Approximately 70% of the barites were ground in Khuzdar and Karachi mills. Nearly 75% of the barite was purchased locally, and most of the exports were sold to oil-producing Middle East countries. Transportation continued to be a problem as the Khuzar-Karachi section of the highway network remained incomplete by yearend 1980.

Cement.—The State Cement Corp. of Pakistan Ltd. continued to address 1980 supply shortfalls by achieving 96% production capacity at the State-run factories, and by extending the cement industry into the

private sector. The Government approved three new cement plants, which were expected to increase production capacity by 900,000 tons per year. Each new plant was designed to produce 300,000 tons of cement annually and was estimated to cost $50 milllion. The Government was expected to cover the foreign exchange component of $28 million, and has required the sponsoring companies to finance the difference for the purchase of domestic plant machinery and equipment. Plant sponsors and locations include Messrs. Naseer A Shaikh and Co. in Taraki, Jhelum district; Farug Ltd. in Lakrai near Nowsherea; and Fecto Ltd. in Sangjiana near Rawalpindi. Construction continued at the Dandot and Thatta Cement projects, and expanded production was scheduled to commence in September 1981.

Fertilizer Materials.—Five fertilizer plants were operating in Pakistan by year-end 1980. Annual production capacities were approximately 1.4 million tons of nitrogenous fertilizers and 0.7 million tons of phosphatic fertilizers. Although output increased through the expansion of the Multan plant and the startup of the Mirpur Mathelo plant during 1980, domestic suppplies have not kept up with demands. Pakistan's objective for nitrogenous fertilizer was self-sufficiency by 1984. Nitrogenous fertilizer production increased 15%, and natural gas consumption, used for fertilizer feedstock, increased 17% over 1979 levels. Pakistan's operating and planned fertilizer plants are listed in table 4.

The Pakistani Government acceded full control of the fertilizer industry in 1972, in accordance with the Industrial Reforms Order. Exceptions included Exxon Chemicals (Pakistan) Ltd. and Dawood Hercules, which have foreign participation, and the proposed Fauji Foundation project, considered neither private nor public because of its multilateral aid sponsors. Although the National Fertilizer Corp. of Pakistan controlled approximately 60% of the production capacity during 1979-80, the private sector contributed roughly 65% of the output. The fertilizer plants were operating at an average production capacity of 55% during 1980, with approximately 70% and 40% plant capacities achieved for nitrogenous and phosphatic fertilizer materials, respectively. Technical problems encountered in the starting up of the new Multan plant were largely responsible for decreased overall efficiencies.

Phosphate.—Extensive phosphate deposits in the Hazara region, NWFP, have been explored since 1975. Preliminary investigations estimated 45 million tons of phosphate rock deposits. A feasibility study was commissioned in July 1980 to establish the economic viability of using the ore for fertilizer production. British mining consultants were expected to aid in the mine design, beneficiation, and transportation requirements. The proposed facility was to be located at Haripur. Phosphate fertilizer production was projected at 89,000 tons per year.

Table 4.—Existing and proposed fertilizer plant operations in Pakistan, 1980

Fertilizer plant	Location and Province	Products	Production capacity (thousand tons per year)	Gasfield	Natural gas consumption (million cubic feet per day)
Dawood Hercules Ltd.	Chickoki, Punjab	Urea	345	Sui	42
Exxon Chemicals (Pak) Ltd	Dharki, Sind	do	173	Mari	35
National Fertilizer Ltd.	Daudkhel, Punjab	Ammonium sulfate	100	Sui	100
Pak-Arab Fertilizers Ltd.[1]	Multan, Punjab	Nitrogenous fertilizers	168	do	40
		Phosphatic fertilizers	70		
Pak-Arab Fertilizers Ltd.[2]	Mirpur Mathelo, Sind.	Ammonia	365	Mari	[3]57
		Urea	639		
Pakistan Ajman Fertilizer Corp. Ltd. (Phase I)[4]	Port Qasim, Baluchistan.	Ammonia	493	Sui	[3]60
		Urea	630		
Hazara Fertilizer Complex (Phase I)[4]	Haripur, NWFP	Nitrogenous fertilizers	61	do	NA.
		Phosphatic fertilizers	89		
Fauji Foundation Fertilizer Project[4]	Machi Goth, Punjab	Nitrogenous fertilizers	258	Mari	NA.

NA Not available.
[1] Joint venture between Pakistan's National Fertilizer Corp. and Abu Dhabi.
[2] Joint venture between Pakistan's National Fertilizer Corp. and Saudi Arabia.
[3] Gas figures were based on designed production capacities.
[4] Plants were scheduled to come online between 1981 and 1983.

Source: Progress (Pakistan Petroleum Ltd.) V. 24, No. 11, June 1980.

Other Nonmetals.—Fluorite and salt continued to be produced in small quantities during 1980. Pakistan's only iodized salt project, located in the Peshawar division, NWFP, was scheduled to commence production late in 1980. The design capacity was expected to be roughly equivalent to 50% of the iodized salt required in the country during 1980.

MINERAL FUELS

Coal.—Modest amounts of lignite coal continued to be produced in Pakistan during 1980. The largest consumer was the brick industry (80%), and the remainder was divided among the railways, small industries, and domestic users. An estimated 442 million tons of recoverable reserves were thought to exist in the Baluchistan, Punjab, and the Sind Provinces. PMDC geologic investigations have estimated that 60 million tons of the reserves were located at Lakhra, Sind. Detailed investigations of the Lakhra Coalfields were completed during 1980. A feasibility report for the coal mine and/or thermal power station complex was expected to be submitted by a Japanese company early in 1981.

Pakistan's Water and Power Development Authority (WAPDA) continued to operate a 15-megawatt coal-fired plant at Sheikh Manda, Baluchistan, during 1980. WAPDA planned to expand thermal facilities by proposing a 125-megawatt plant at Jamshoro, Sind, and a 200-megawatt plant at Kot Adu, Punjab. Both projects were pending Government approval by yearend 1980.

PMDC initiated a $2.5 million coal washing plant at Sharigh, Baluchistan, in May 1980. Approximately 75,000 tons of washed coal per year (containing 4% sulfur) was expected to be combined with better-quality imported coal at Karachi, and utilized in steel production. The washed coal supplies represent 10% of the quantity required by PASMIC's Pipri steel mills at full production. Sharigh colleries improved their facilities during 1980 through the completion of six electrohydraulic winches, with reported line pull capacity of 21 tons at 400 feet per minute.

Natural Gas.—Thirteen known fields were estimated to contain approximately 14 trillion cubic feet of gas reserves during 1980. Gas-producing fields including Sui, Mari, Sari Sing, and Hundi comprised nearly 90% of the reserves. The Sui Fields were the largest producing fields in Baluchistan, with estimated proven reserves at 8 billion cubic feet. The Sui Fields production capacity was 900 million cubic feet of high-quality, 88% methane gas in 1980. Other gasfields including Dhodak, Kandhkot, Khairpur, Kothar, Mazarani, Pirkoh, and Rodho were awaiting market development by yearend 1980.

Pakistan Petroleum Ltd. (PPL) held the concession rights for Sui, Kandhkot, Khairpur, and Mazarani Gasfields during 1980. PPL acquired Attock Oil Co. Ltd. (U.K.) in July 1980, which expanded PPL's scope of petroleum and natural gas production and distribution. Under the agreement, the Dhulian liquefied petroleum gas (LPG) plant was transferred to PPL, and a new price formula for crude oil and LPG was agreed upon.

Pipelines extending from Peshawar in the NWFP to Karachi in the southern part of Baluchistan, connected most of the operating gas-producing areas. Sari Sing and Hundi were tied into the Sui-Karachi section of the pipeline and contributed 10% of the gas supplied to the national gas grid during 1980. The Pirkoh Field, 72 kilometers northwest of Sui, was expected to be integrated with the grid, adding 120 million cubic feet per day by 1983. A new pipeline connecting the Pirkoh Field and extending supplies west to Quetta, was expected to be financed by international aid agencies.

The Sui-based Gudu power station was expected to become Pakistan's largest thermal powerplant. Phase 2 of the project, adding a 210-megawatt capacity to the existing 229-megawatt plant, was nearing completion by yearend 1980.

Petroleum.—Pakistan had an estimated 0.5 to 1 billion barrels of recoverable oil located primarily in the Potwar and Indus Basins during 1980. Average production increased nearly 5% in the following oilfields between 1979 and 1980; Balkassar, Dhulian Joya Mair, Khaur, Meyal, and Tut. The Meyal Fields continued to supply the largest output, representing over 50% of the total production. The Adhi Fields, discovered in the Potwar Basin in 1979, were brought into production during March 1980.

Oil exploration and development received an 87% increase in 1980-81 Government allocations. The Pakistani Government Oil and Gas Development Corp. (OGDC) implemented a $73 million drilling program. Thirty wells were expected to be drilled during 1980-81, double the amount drilled in the previous year. Eleven exploration companies were active in Pakistan during 1980, including OGDC, two private Pakista-

ni companies, and eight major international companies. Pakistan Shell Petroleum Development, a subsidiary of the Royal Dutch/Shell Petroleum Co., signed an agreement for extended exploration and petroleum production. The 2,792 square miles located near the borders of the Baluchistan and Punjab Provinces, were part of Shell's original concession and have already undergone seismic surveys. British Petroleum Co. Ltd. (BP) signed an exploration contract with Pakistan in October 1980, making BP the ninth international oil company with interests in the country. BP was expected to conduct and finance 97.5% of the cost for three deep wildcats. Exploration of 5,460 square miles was to take place in southeastern and central Pakistan in the Baluchistan and Sind Provinces, at a cost of $22 million.

Refinery capacities were increased from 4.7 million tons per year in 1978 to 5.2 million tons per year in 1980. Pakistan's objective was to become self-sufficient in refined products by 1983. National Refinery Ltd. was negotiating a design contract with Lumus Co. Ltd. to enlarge the Karachi refinery. The expansion program was expected to add vacuum distillation, deasphalting, extraction, and dewaxing units. Consequently, refinery capacity for lube base stocks was expected to increase by 100,000 tons per year. A new pipeline transporting various finished petroleum products, and extending 865 kilometers between Karachi and Multan, was expected to be commissioned by yearend 1980.

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[1]Physical scientist, Branch of Foreign Data.

[2]Pakistan's fiscal year is from July 1 to June 30.

[3]Where necessary, values have been converted from Pakistani rupees (PRs.) to U.S. dollars at the rate of PRs9.90=US$1.00.

[4]U.S. Embassy, Islamabad, Pakistan. State Department Airgram A-78, May 5, 1980, p. 3.

The Mineral Industry of Peru

By Doris M. Hyde[1]

In 1980, the Peruvian economy registered a gross domestic product (GDP) of $7.7 billion.[2] The real growth rate of 3.1% was slightly lower than the 3.8% rate for 1979, but still compared favorably to the declines experienced during 1977 and 1978. The 1980 rate of inflation was almost 61%, only slightly below the 67% recorded for 1979.

Peru's mining sector accounted for 9.5% of the GDP in 1980, and the value of mineral exports represented 48% of total export earnings, a slight gain over the 45% contribution in 1979. The increased value of mineral exports was primarily a result of the high average price of silver, which practically doubled relative to the 1979 price average.

The value of 1980 petroleum exports reached $810 million and for the first time exceeded the export value of copper, estimated at about $759 million. Petroleum exports contributed almost 21% to the $3.9 billion value of total exports.

The large mining sector, composed of three state-owned companies and the privately owned Southern Peru Copper Corp. (SPCC), suffered to varying degrees from labor unrest and a severe drought in the north. SPCC has traditionally been Peru's major copper and molybdenum producer. During 1980, the company was negotiating with the Government concerning a major expansion program at the Toquepala and Cuajone mining areas in southern Peru.

In addition to operating its six mining units and the La Oroya metallurgical complex in central Peru, Empresa Minera del Centro del Perú (CENTROMÍN) was actively involved in an exploration program in the southeastern jungle region where it already owns two large gold placer concessions. The company also ventured into southern Peru, where a polymetallic deposit northeast of Tacna was under study.

Empresa Minera del Perú (MINERO PERÚ) inaugurated the Cajamarquilla zinc refinery in May 1980. Considerable public criticism was aroused because of the possible environmental hazards resulting from transporting the sulfuric acid byproduct from the refinery to the Cerro Verde Mine in Arequipa Department in southern Peru.

In 1980, the small and medium mining sectors both achieved production gains over those of 1979 by 19% and 12%, respectively. The decreased tonnage from the large mining sector offset these gains for the most part, and Peru's overall mining production of the five leading minerals—copper, lead, silver, zinc, and iron ore—was down almost 5%.

Government Programs and Policies.—Following a 1980 review of problems affecting the mining industry, the Government drafted a series of provisions to modify the existing petroleum and mining laws in an effort to revitalize production, which, except for copper, has not shown significant growth for the last decade.

The mining legislation did not pass in 1980, but action was expected early in 1981. Changes in the mining law were expected to reduce the 17.5% export tax, which has been an important revenue source for the Government but has also discouraged investment. Other changes are expected to affect the reinvestment allowance. The Government announced the Minero Perú Commercial (MINPECO) may lose its monopoly on the internal and external marketing of metals and minerals. Such an action would not have an impact until existing company contracts with MINPECO expire. MINPECO now receives a 2% commission on sales,

an amount viewed unfavorably by the mining community. Under the proposed changes, MINPECO would continue to market production from the state-owned enterprises and any private corporations requesting their services.

It was also announced that the structure of the state-owned enterprises MINERO PERÚ, MINPECO, Electricidad del Peru, and Petróleos del Perú (PETROPERÚ) may be altered so that they can function as private corporations. The Government would maintain its 100% ownership, as in the case of CENTROMÍN and Empresa Minera de Hierro del Perú (HIERRO PERÚ), which are already organized in this manner.

It was under the shadow of steadily declining crude oil reserves and production and increasing domestic consumption that the Government enacted the 1980 changes in the petroleum law. This action followed the December 1979 publication of guidelines to govern oil contracts with the then active foreign contractors.

Law No. 23231 of December 28, 1980, permits tax credits of up to 40% of net income for foreign and mixed oil companies operating north of latitude 7° S. (northern Peru), and 50% for those operating south of latitude 7° S., providing the company has invested in its own activity or reinvested in other oil companies a minimum of $20 million. The tax credit must be taken during the fiscal year in which the investment is made or during the three immediately following fiscal years. PETROPERÚ no longer has exclusive rights to secondary recovery programs. Private Peruvian and foreign contractors may now, "in exceptional circumstances," sign operation and service contracts with PETROPERÚ concerning secondary and tertiary recovery operations with the approval of the Council of Ministers.

The tax incentive measures are intended to remain in force until 1999. Implementing regulations are expected in 1981. These changes were expected to stimulate the growing interest foreign oil companies have shown in initiating exploration in Peru.

PRODUCTION

The value of Peru's five most important mineral products—copper, lead, silver, zinc, and iron ore—decreased nearly 5% compared with their 1979 value. The major reason was an 8% drop in copper production due to strikes and a severe drought in northern Peru, which affected mining operations in that region. CENTROMÍN operated six mines in central Peru and remained the major producer of metals and sub-products at its La Oroya metallurgical complex located west of Lima. CENTROMÍN's production is shown in table 2. In addition, CENTROMÍN produced 239,248 tons of zinc concentrates for export and 294 tons of tungsten concentrates for export. A significant proportion of the metals produced at La Oroya come from custom concentrates purchased from smaller mining and concentrating operations—30% to 40% of the copper, 50% to 60% of the silver, and 32% to 47% of the lead. In 1980, an annual record high was set by CENTROMÍN in the recovery of selenium, copper sulfate, and zinc sulfate. Overall, CENTROMÍN failed to meet 1980 programed production goals because of labor problems and drought.

Crude oil production increased marginally, primarily owing to improved secondary recovery operations. Domestic consumption rose almost 8% in 1980, compared with the 5% consumption increase experienced in 1979.

Peru does not have a central statistical gathering agency. Except for information available from Banco Minero, MINPECO, and the various producing companies, there is no other source of data. The last published information on nonmetallic mineral production was for 1976. There is a possibility that in the near future—1 to 3 years—MINPECO will assume the responsibility for gathering nonmetallic mineral information.

Table 1.—Peru: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Antimony:					
Mine output, metal content	r168	r819	745	762	1,050
Metal	r148	504	489	477	806
Arsenic, white	r1,042	1,367	1,257	3,222	3,205
Bismuth:					
Mine output, metal content	r597	r644	611	527	431
Metal	456	516	611	527	431
Cadmium:					
Mine output, metal content	r429	380	e350	424	NA
Metal	174	182	169	190	163
Copper:					
Mine output, metal content	r228,407	r327,071	366,400	400,385	367,557
Copper sulfate (Cu content)	r1,031	1,311	1,228	1,395	4,665
Metal:					
Smelter	r216,204	r307,425	318,900	371,385	321,021
Refined	r98,670	r187,183	182,754	230,835	226,299
Gold:					
Mine output, metal content, troy ounces	r121,031	104,393	103,069	141,656	148,890
Metal, do.	r89,029	89,315	88,182	93,269	120,900
Indium, kilograms	r3,721	3,734	3,302	3,484	3,675
Iron and steel:					
Iron ore and concentrate:					
Gross weight, thousand tons	r7,130	6,284	4,921	5,444	5,730
Iron content, do.	4,722	4,064	3,199	3,622	3,722
Metal:					
Pig iron, do.	232	244	244	265	261
Ferroalloys	320	e500	e1,800	e1,800	e1,800
Steel ingots and castings, thousand tons	349	379	374	436	471
Lead:					
Mine output, metal content	r174,707	r175,708	182,704	174,000	176,955
Metal	r80,610	r79,258	74,269	85,706	79,939
Manganese ore and concentrate:					
Gross weight	(2)	--	--	--	--
Metal content	(2)	--	--	--	--
Molybdenum, mine output, metal content	r446	r456	729	1,086	1,616
Selenium metal, refined, kilograms	r8,743	r15,936	12,927	18,320	27,535
Silver:					
Mine output, metal content, thousand troy ounces	r38,661	r38,812	37,045	43,415	40,500
Metal, do.	r20,734	r22,379	20,859	25,457	22,509
Tellurium metal, kilograms	12,306	18,370	15,382	21,202	20,104
Tin, mine output, metal content	r299	r366	800	929	1,202
Tungsten, mine output, metal content	r845	526	582	599	555
Zinc:					
Mine output, metal content	r456,069	405,384	457,500	432,000	403,291
Metal	r115,037	66,949	68,436	68,195	61,544
NONMETALS					
Barite	r359,418	r440,944	531,670	166,862	250,000
Cement, hydraulic, thousand tons	r1,887	r1,929	2,020	e2,500	e3,000
Chalk	r338,949	r362,798	269,755	361,800	485,174
Clays:					
Bentonite	r34,788	r31,200	18,805	--	--
Fire clay	r9,800	r9,682	13,037	13,250	13,325
Kaolin	r3,697	r2,698	3,752	4,052	5,500
Common clays	r222,606	r272,193	252,948	399,090	309,800
Diatomite	r16,219	r8,474	4,923	(2)	--
Feldspar	r9,458	r2,184	2,461	2,176	15,600
Graphite	(2)	(2)	(2)	(2)	--
Gypsum, crude	r234,781	142,751	168,936	217,490	280,000
Mica	r55	r150	100	e50	e60
Nitrogen: N content of ammonia	75,000	83,000	81,000	e80,000	61,700
Phosphates, crude: Guano	2	--	--	--	--
Salt, all types	r519,283	r317,857	348,056	398,820	456,987
Stone, sand and gravel:					
Dimension stone:					
Marble	r14,535	2,461	7,067	14,535	NA
Slate	r19,114	r30,300	25,300	NA	NA
Crushed and broken stone:					
Dolomite	23,052	r7,535	5,510	--	--
Limestone	r3,231	r2,764	3,371	2,810	3,175
Quartz and quartzite	r489	r2,250	2,170	NA	NA
Silica, thousand tons	155	r174	80	NA	NA
Sand and gravel, do.	r3,547	r3,291	2,887	2,577	3,596
Sulfur:					
Elemental:					
Native	r250	r109	102	98	--

See footnotes at end of table.

Table 1.—Peru: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sulfur —Continued					
Elemental —Continued					
Byproduct of metallurgy	16,300	20,000	18,000	e20,000	e20,000
Sulfuric acid including oleum, gross weight	47,756	50,983	47,292	45,000	e47,000
Talc and related materials:					
Talc	r1,547	721	231	2,700	e2,700
Pyrophyllite	r10,390	10,714	8,678	13,270	e12,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	2,130	5,698	5,661	3,182	e3,500
Coal:					
Anthracite	r21,471	r27,847	41,235	45,892	89,471
Bituminous[e]	(3)	(3)	(3)	(3)	(3)
Coke, all types[e]	10,000	10,000	10,000	10,000	10,000
Gas, natural:					
Gross, million cubic feet	71,597	72,763	68,970	73,118	e67,500
Marketed, do.	e32,500	e32,900	31,877	21,053	e21,000
Natural gas liquids:					
Natural gasoline and other[4] thousand 42-gallon barrels	508	493	521	464	353
Propane, do.	79	74	60	47	75
Butane, do.	7	8	7	9	9
Total, do.	594	575	588	520	437
Petroleum:					
Crude, do.	27,936	33,276	55,079	69,952	71,369
Refinery products:					
Gasoline:					
Aviation, do.	1	(3)	(3)	1	e(3)
Motor, do.	12,336	11,981	11,102	13,088	12,810
Jet fuel, do.	1,628	1,325	1,812	2,657	3,220
Kerosine, do.	4,990	5,017	5,538	6,156	6,741
Distillate fuel oil, do.	7,710	7,304	9,746	11,949	12,339
Residual fuel oil, do.	13,194	15,448	14,523	15,462	16,622
Lubricants, do.	108	63	70	141	85
Other:					
Liquefied petroleum gas, do.	1,091	1,220	1,274	1,237	1,145
Asphalt, do.	296	246	212	181	181
Unspecified, do.	150	217	122	104	159
Refinery fuel and losses, do.	488	505		193	254
Total, do.	41,992	43,326	44,399	51,169	53,556

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Oct. 12, 1981.
[2]Revised to zero.
[3]Less than 1/2 unit.
[4]Includes hexane.

Table 2.—Peru: Smelter and refinery production of CENTROMÍN

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980	Programmed for 1981
Refined metals:						
Copper	45,786	55,022	51,897	54,291	54,104	57,430
Lead	74,066	79,243	74,255	85,112	81,976	86,380
Zinc	64,382	66,949	62,852	68,196	63,829	68,580
Silver, troy ounces	19,227,701	21,572,344	20,896,528	r25,488,117	23,970,564	26,000,000
Gold, do.	r34,679	36,369	32,220	42,937	42,455	40,000
Bismuth	456	516	611	523	498	560
Cadmium	174	182	170	190	172	180
Indium, kilograms	3,271	3,734	3,302	3,845	3,610	3,730
Selenium, do.	8,743	15,936	12,941	18,320	22,908	19,050
Tellurium, do.	12,306	18,370	15,418	21,233	20,920	21,770
Metals in blister copper for export:						
Copper content	5,525	1,486	--	r1,340	1,859	--
Silver content, troy ounces	r1,231	303,524	--	r292,849	383,555	--

See footnotes at end of table.

Table 2.—Peru: Smelter and refinery production of CENTROMÍN —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980	Programmed for 1981
Metals in blister copper for export — Continued						
Gold content troy ounces	2,215	569	--	r629	981	--
Subproducts:						
Antimony, crude	315	528	488	477	427	460
Antimonial lead	44	102	9	r95	15	--
Arsenic trioxide	r797	1,405	1,322	r1,415	3,475	NA
Copper sulfate	4,422	5,625	5,271	5,987	6,038	6,800
Zinc sulfate	1,823	2,039	1,826	2,003	2,283	1,810
Sulfuric acid	47,756	50,983	47,292	53,762	51,802	54,430

rRevised. NA Not available.

Source: CENTROMÍN Annual Report 1980.

TRADE

The Central Reserve Bank preliminary statistics on the value of nonfuel mineral exports in 1980 indicated a record $1.86 billion, more than 19% above the $1.56 billion exported in 1979. Exports were subject to erratic and somewhat declining international mineral prices during the second half of 1980. The United States and Japan continued to be the major markets for Peruvian mineral exports, with silver, copper, and lead accounting for the largest values in the case of the United States, and copper, zinc, iron, and lead for Japan.

In 1980, mineral exports accounted for 48% of the total value of exports. Copper and silver were the major nonfuel mineral foreign exchange earners, together accounting for 72% of the value of nonfuel mineral exports.

In 1980, the value of petroleum exports reached $810 million and surpassed that of copper. Crude oil exports averaged about 48,000 barrels per day, compared with 1979 exports of about 52,000 barrels per day and 1978 exports of 29,300 barrels per day.

Preliminary 1980 mineral exports through MINPECO, the state agency in charge of marketing all Peruvian minerals, are shown in the following tabulation:

Product	Quantity (metric tons)		Percent change	F.o.b. value (thousands of U.S. dollars)		Percent change
	1979	1980		1979	1980	
Refined copper cathode	175,928	180,054	2	330,196	384,163	16
Refined copper bars	31,511	26,642	-15	57,873	56,407	-3
Refined copper rods	5,549	3,202	-42	10,429	7,054	-32
Blister copper[1]	[1]139,578	[1]126,985	-9	248,830	274,317	10
Copper concentrates	[1]113,441	[1]69,811	-38	54,313	36,687	-32
Copper cement	[1]1,675	--	--	2,157	--	--
Total copper	XX	XX	XX	703,798	758,628	8
Refined lead	86,037	74,227	-14	96,156	65,503	-32
Lead concentrates	[1]139,409	[1]152,998	10	234,105	316,711	35
Lead carbonate	--	[1]2,822	--	--	1,211	--
Total lead	XX	XX	XX	330,261	383,425	16

See footnotes at end of table.

Product	Quantity (metric tons)		Percent change	F.o.b. value (thousands of U.S. dollars)		Percent change
	1979	1980		1979	1980	
Refined silver	740	485	-34	222,334	312,150	40
Refined zinc	56,697	37,532	-34	38,235	26,721	-30
Zinc concentrates	[1]664,611	[1]755,042	14	121,207	146,502	21
Others	[1]25,045	[1]60,084	140	14,116	39,437	179
Total zinc	XX	XX	XX	173,558	212,660	23
Crude antimony	102	--	--	204	--	--
Refined bismuth	371	554	49	2,047	2,751	34
Refined cadmium	210	179	-15	1,173	950	-19
Indium	4	3	-25	1,608	1,652	3
Selenium	12	3	-75	333	59	-82
Tellurium	12	5	-58	505	206	-59
Arsenic trioxide	1,519	351	-77	635	178	-72
Tin concentrates	[1]2,355	[1]2,214	-6	18,984	18,741	-1
Molybdenum concentrates	[1]2,131	[1]2,995	41	52,953	28,909	-45
Tungsten concentrates	[1]1,131	[1]996	-12	10,832	10,149	-6
Antimony ores	[1]738	[1]378	-49	729	494	-32
Total various products	XX	XX	XX	90,003	64,089	-29
Iron ore	[2]5,529,934	[2]5,500,328	-0.5	85,130	94,796	11.4
Grand total	XX	XX	XX	1,605,084	1,825,748	13.7

XX Not applicable.
[1]Dry metric tons.
[2]Dry long tons.

Table 3.—Peru: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Antimony:				
Ore and concentrate, metal content	796	738	--	Belgium 323; France 127; West Germany 113.
Metal including alloys, all forms	386	102	102	
Arsenic trioxide, pentoxide, acid	29	1,519	450	Chile 1,019.
Bismuth metal including alloys, all forms	105	373	220	United Kingdom 75; U.S.S.R. 50.
Cadmium metal including alloys, all forms	198	210	141	Netherlands 38; Brazil 28.
Copper:				
Ore and concentrate, metal content	195,738	115,116	2,781	Japan 75,320; Spain 19,798.
Metal including alloys:				
Scrap	141	--		
Unwrought:				
Blister	134,592	139,578	28,548	Japan 31,083; China, mainland 30,737; United Kingdom 24,940.
Other	163,932	207,439	28,926	Brazil 36,831; Japan 32,474; Italy 27,357.
Semimanufactures	10,273	5,549	--	Colombia 1,682; El Salvador 1,650; Costa Rica 1,350.
Indium metal including alloys, all forms	4	4	3	Japan 1.
Iron and steel: Ore and concentrate excluding roasted pyrite, gross weight thousand tons	4,694	5,619	498	Japan 2,408; Republic of Korea 1,270.
Lead:				
Ore and concentrate, metal content	147,262	139,409	45,236	Japan 33,512; Mexico 30,970; Belgium 9,538.
Metal including alloys, unwrought	91,506	86,037	29,187	Italy 22,359; China, mainland 10,494; Republic of Korea 7,148.
Molybdenum ore and concentrate, metal content	1,118	2,131	372	West Germany 1,000; United Kingdom 276.
Selenium metal including alloys, all forms	11	12	--	Brazil 9.
Silver metal including alloys, unwrought thousand troy ounces	22,538	23,792	14,211	Japan 3,569; Brazil 2,411; East Germany 1,415.

See footnotes at end of table.

Table 3.—Peru: Exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Tellurium metal including alloys, all forms	13	12	1	West Germany 3; Netherlands 3.
Tin ore and concentrate, metal content	1,786	2,355	263	Mexico 1,474; West Germany 608.
Tungsten ore and concentrate, metal content	1,024	1,131	597	Japan 348; West Germany 91.
Zinc:				
Ore and concentrate, metal content	704,828	664,611	47,304	Japan 183,498; France 105,314; Belgium 87,155.
Metal including alloys, unwrought	64,935	56,697	12,321	Brazil 15,726; Colombia 9,003.

[1]This table should not be taken as a complete presentation of Peru's mineral exports. Peru's official trade statistics for 1978 and 1979 are not available; the source of the data presented in this table was "Metales y Minerales Peruanos para el Mundo," Officina de Planificacion y Estadistica.

COMMODITY REVIEW

METALS

Copper.—The following tabulation shows the principal producers of copper ores and concentrates, in metric tons of copper:

Company	1979	1980	Percent change
Southern Peru Copper Corp.:			
Toquepala Mine	107,552	108,491	1
Cuajone Mine	183,521	150,829	-18
CENTROMÍN	27,669	26,978	-3
MINERO PERÚ (Cerro Verde Mine)	33,100	33,279	0.5
Minas Aguila, S.A	5,410	6,900	28
Cía. Minera Pativilca, S.A	4,920	4,600	-7
Northern Peru Mining Corp	3,095	3,515	14
Cía. Minera Condoroma, S.A	3,585	3,250	-9
Cía. Mineral del Madrigal	2,595	2,945	13
Minas de Cobre de Chapi, S.A	2,300	2,360	3

Total 1980 copper production decreased about 8% from 1979, mainly resulting from a 28-day strike at SPCC's Cuajone Mine and a 33-day strike at the concentrator. The Toquepala Mine lost 18 days of production owing to strike activity. SPCC was negotiating with the Government relative to a $220 million expansion program. Plans included a $150 million investment at Toquepala to increase ore reserves and to expand concentrator production from 110,000 to about 145,000 tons per year, and a $70 million investment at the Cuajone Mine operation to increase the capacity of the concentrator to accommodate a lower grade ore and, therefore, enable the plant to maintain present copper output.

CENTROMÍN, the third largest copper producer, completed the basic engineering study for modernizing the copper refinery at La Oroya. Work is to begin during the last half of 1981 with completion expected to take 4 years in order to maintain the plant in an operating status during construction. At the Cobriza Mine, infrastructural and development work was initiated for expansion and a new concentrator. It was estimated that construction would be concluded by mid-1982.

A CENTROMÍN subsidiary, Cía. Minera Los Montes S.A., received loans to begin construction on the $13.7 million Monterro-

sas copper mine and concentrator to be located in Ica Department. Initial output is scheduled for 1982. Capacity production was set at about 17,000 tons per year of copper concentrate averaging 25% copper, and 70 tons per year of molybdenum concentrate averaging 53% molybdenum. Ore reserves at Monterrosas were estimated at 1 million tons grading 8% copper.

CENTROMÍN awarded a feasibility study contract on the Toromocho polymetallic deposit located in Morococha district, about 142 kilometers east of Lima. Studies were first initiated on this deposit in 1963. The present study has a completion date of late 1981 and includes the possibility of a separate mining and metallurgical complex. Under consideration are an opencast mine and crusher, transport to a 32,000-ton-per-day flotation concentrator, and a dump leaching area for metal recovery from marginal ore. Later stages of development could locate a metallurgical complex in the Pucara Valley east of the Toromocho concentrator. The metallurgical complex envisioned consists of a smelter and refinery to produce 83,000 tons per year of refined copper, molybdenum and tungsten separation plants, an anode slimes plant to recover silver and other metals, and a sulfuric acid plant. Another possible addition to the metallurgical complex would be the incorporation of a 180,000-ton-per-year lead smelter to accommodate concentrates from other mines in the area. The metals of economic interest contained in the Toromocho ore deposit were described as follows, calculated on proven ore reserves of 354 million tons averaging 0.75% copper and using a cutoff grade of 0.5% copper:

Metal	Average grade, percent	Estimated metal content
Copper ____ metric tons__	0.75	2,655,000
Lead ____ do____	.031	109,700
Zinc ____ do____	.145	513,300
Silver ____ ounces__	[1].2711	95,970,000
Gold ____ do____	[1] .00007	24,780
Molybdenum __ metric tons__	.013	46,000
Bismuth ____ do____	.005	17,700
Tungsten ____ do____	.024	85,000
Arsenic ____ do____	.045	159,300
Antimony ____ do____	.0082	28,300

[1]Troy ounces per metric ton.

Using a cutoff grade of 0.4% copper, Toromocho ore reserves were estimated at 500 million tons. In addition, 530 million tons of leachable ore has been identified where the average grade is 0.39% copper with a 0.2% cutoff.

The magnitude of the Toromocho project was believed to be beyond the resources available to CENTROMÍN and that one or more private Peruvian or foreign partners would be required to realize the project.

MINERO PERÚ, the second largest copper producer, continued to operate the Cerro Verde Mine and Ilo copper refinery with no significant changes during 1980. Potential investors have been contacted for the first phase of expansion at the Cerro Verde Stage II deposit, but negotiations were not held during 1980. Cerro Verde is a wholly MINERO PERÚ operation, and the company must decide whether this second stage should be independent of the first stage or whether a new company should be formed, perhaps using the "Tintaya model" to take over the operations of both stages.

The magnitude of the Cerro Verde Stage II project will probably require a three-phase development program. Under the proposed first phase of Stage II, copper production would be increased to 20,000 tons per day of ore yielding 200,000 tons per year of 28% to 30% copper concentrate containing about 50,000 tons per year of copper. The first phase of the second stage plan was given a cost estimate of $290 million. The project ultimately involves the development of about 1.2 billion tons of copper sulfide, averaging 0.65% copper, underlying the 61 million tons of oxide ores which have been under production since 1977.

MINERO PERÚ's first priority, however, has been the development of the Tintaya copper deposit located in the Province of Espinar in southern Peru. In March 1980, the Government established the Empresa Estatal Minera Asociada Tintaya S.A. (EMATINSA) to develop this deposit. The new company is owned by three Government agencies: MINERO PERÚ (45%), CENTROMÍN (45%), and the Financial Development Corp. (COFIDE) (10%). Initial capitalization was $100 million. A Canadian company, Nenninger and Chennevert, was awarded the contract to undertake project management and provide technical assistance.

In accordance with Government policy, projects such as Tintaya should be self-

financed with private national and foreign capital to reduce Peru's risk and financial obligation. EMATINSA has held negotiations with several foreign companies interested in the project. Equity would be divided between MINERO PERÚ (minimum of 25%), Peruvian investors (30%), and foreign investors (40% to 45%). Any remaining equity would be covered by the International Finance Corp. with the provision that these shares will eventually be sold preferentially to Peruvian investors. Total cost of the project has been estimated at almost $300 million. EMATINSA has negotiated a $250 million loan from Canada's Export Development Corp. and a banking group.

EMATINSA has initiated infrastructual and development work and tentatively planned that the operation will be onstream by 1984 at a projected mining rate of 8,000 tons per day, yielding 160,000 tons per year of 33% copper concentrate. Ore reserves at Tintaya have been placed at 10 million tons of oxides containing an average of 2.2% copper, and 41 million tons of sulfide averaging 2% copper. The mine life has been estimated at between 16 and 25 years, depending on the rate of extraction.

Empresa Minera Especial Asociada Antamina S.R.L., owned by MINERO PERÚ (51%) and the Romanian state mining agency Geomin (49%), has rejected a third feasibility study but agreed to modify the original plans to reduce costs. Changes included a shift from a 20,000-ton-per-day operation costing $530 million to a two-stage plant of 10,000 tons per day, costing $326 million for the first stage. Financing was not secured during 1980, and some organizational changes could be advanced that would modify the company structure. The Antamina copper-zinc deposit, located in the Province of Huari, Department of Ancash, some 50 miles east of Huarás, has proven ore reserves of about 166 million tons containing 1.3% copper, 1.1% zinc, 0.04% molybdenum, and 0.48 ounce of silver per ton.

MINERO PERÚ's copper refinery, located 3 miles from both the Port of Ilo and SPCC's smelter, was scheduled for expansion. The company was evaluating several proposals for increasing capacity from 150,000 tons per year to 225,000 tons per year. Production from this refinery declined slightly in 1980 owing to a decrease in the supply of blister copper from SPCC's smelter.

A severe drought in northern Peru seriously affected operations at Minas Aguila S.A.'s new copper mine in the Province of Sihuas, Department of Ancash. The mine operated at one-half of its planned 60,000-ton-per-year production but was still the largest copper producer in the medium sector. In order to avoid similar water problems in the future, the company extended its water canal by 12 kilometers into the lakes of the Cordillera Blanca.

The 150,000-ton-per-year flash smelter planned for construction at Chimbote by Fundiciones del Norte, S.A., has been temporarily postponed pending a favorable decision from COFIDE on financing arrangements. The $15 million smelter was planned to accommodate production from the Aguila Mine and from other private mines in the area.

Amax Exploration, Inc., has been conducting exploration studies at the Pashpap copper-molybdenum deposit located 380 kilometers north of Lima in the Department of Ancash. This deposit was formerly owned by Homestake Mining Co. By the end of 1980, drilling had indicated 60 million tons of ore containing 0.8% copper and 0.053% molybdenum. Amax planned to reevaluate data so far gathered on Pashpap and also identify additional areas of mineralization that would justify development.

Gold.—The largest gold production continued to come from placer mining in the southeastern jungle region, with Puerto Maldonado, Department of Madre de Dios, as the center of activity. Mining in this area has been primarily by individual miners using elementary methods, although there are a few medium-sized operations owned by Peruvian and foreign interests that employ more sophisticated mining techniques. In 1980, gold production from the Madre de Dios area, in ounces, was as follows:

Puerto Maldonado	15,487
Laberinto	12,974
Huaypetue	7,315
Mazuco	4,984
Colorado	3,455

CENTROMÍN has two gold concessions of 15,000 hectares each, located on the Madre de Dios and Inambari Rivers, 80 and 110 kilometers, respectively, west of Puerto Maldonado. CENTROMÍN has done exploratory drilling in the Bijahual area where auriferous gravel layers have reportedly

averaged 0.0096 ounce per cubic meter. Information gathered so far indicates the existence of widely distributed auriferous gravels that have a thickness of 50 meters overlying the bedrock. A pilot plant has been purchased to treat the gravel at a rate of 12 cubic meters per hour. It was expected to be located on the Madre de Dios River concession to enhance gold recovery and also to extract other minerals such as titanium, zircon, tin, and magnetite. CENTROMÍN may join with an interested foreign company to develop this prospect.

MINERO PERÚ conducted preliminary studies on its San Antonio de Poto concession in the Department of Puno. The company obtained credit financing to install equipment to treat 1,500 cubic meters of gravel per day to produce about 4,730 ounces of gold annually. During 1980, the concession produced 155 ounces of gold using incomplete equipment. Several foreign and national companies have expressed an interest to participate in this project and MINERO PERÚ was expected to render a decision in 1981 regarding possible partners.

In the northern jungle, important placer gold areas are Santa María del Nieva, Bagua, and Saramiriza. Several northern mining groups were also milling from gold vein deposits. Cía. Minera Poderosa was developing the La Lima deposit, located in the Province of Pataz, Department of La Libertad. Here, a 200-ton-per-day mill was installed to treat ore grading 0.29 ounce of gold per ton. The mine was expected to become operational in 1982. In the southern coastal region the largest gold producers were Minas Ocoña S.A., Oro Arequipa S.A., Explotora S.A., and Santa Clarita S.A., all new companies with the exception of Ocoña.

The increased market value of gold continued to lure miners and investors to Peru. In 1980, the average price of gold was over $612 per ounce as opposed to the average $306 per ounce received in 1979.

Recoverable gold production by sources is shown, in ounces, in the following table:

	1979[p]	1980[p]	Percent change
In ores and concentrates	15,143	11,028	-27
In blister	13,921	12,957	-7
Refined	42,857	45,043	5
In placer gravels[1]	69,735	79,862	15
Total	141,656	148,890	5

[p]Preliminary
[1]As reported by Banco Minero del Peru, Memoria 1980.

The Banco Minero purchased 73,754 ounces of gold in 1980, a 13% increase over the 65,266 ounces purchased in 1979. The bank exported 64,591 ounces of gold in 1980, mainly to the United States.

The principal producers of gold in ores and concentrates are shown in table 4.

Table 4.—Peru: Principal producers of gold in ores and concentrates

Company	1979 (ounces)	1980 (ounces)	Percent change
Minas Ocoña S.A	13,447	11,402	-15
CENTROMÍN	8,084	5,982	-26
Cía. Minera Castrovirreyna S.A	6,401	5,725	-11
Minas de Arcata S.A	4,232	4,791	+13
Cía. Minera Milpos, S.A	3,957	4,218	+7
Cía. Minera Atacocha S.A	3,892	3,854	-1
Cía. Minera Millotingo S.A	2,931	3,151	+8
Northern Peru Mining Co	2,952	2,776	-6

Iron Ore.—State-owned HIERRO PERÚ and the West German company, Klöckner-Humboldt-Deutz Aktiengesellschaft signed an agreement for a prefeasibility study on the recovery of copper, nickel, and cobalt from tailings of the San Nicolás plant. The study was to include the installation of a sulfuric acid plant. HIERRO PERÚ wants to diversify its production rather than rely solely on iron ore, which has suffered from a depressed market for several years. HIERRO PERÚ's 1979-80 production, by categories, is shown in the following table, in thousand metric tons:

Production	1979	1980	Projected 1981
Pellets	1,784	1,564	2,235
High-grade sinter feed	1,953	2,800	3,048
Pellet feed in slurry form	530	265	--
Pellet feed in cake form	1,177	1,076	1,422
Total	5,444	5,705	6,705

Iron exports in 1980 amounted to 5,586,500 tons, of which Japan purchased 44% and Korea, 31%. Smaller shipments were sent to Romania, Yugoslavia, the United States, Argentina, and Czechoslovakia.

Lead and Zinc.—CENTROMÍN remained Peru's largest lead and zinc producer by a wide margin. Improved metal recovery of the concentrates were obtained at its Cerro de Pasco and Morococha units. Lower production from the medium mining sector reduced the overall positive effects of gains made by CENTROMÍN and some privately held companies, as shown in table 5. Labor problems and an emphasis on silver recovery on the part of several companies were responsible for decreases in production from the private sector.

Table 5.—Peru: Mine output of principal lead and zinc producers

(Metric tons of metal content)

	Lead			Zinc		
	1979	1980	Percent change	1979	1980	Percent change
CENTROMÍN	72,943	75,707	4	203,802	203,620	--
Cía. Minera San Ignacio de Morococha	NA	NA	--	32,960	34,620	5
Cía. Minerales Santander, Inc	NA	NA	--	20,365	23,420	15
Cía. Minera Milpo, S.A	10,505	11,430	9	21,540	21,750	10
Cía. Minera Santa Luisa	8,620	7,327	-15	22,355	16,770	-25
Cía. Minera Atacocha S.A	14,005	13,589	-3	17,150	17,237	1
Volcan Compañia Minera, S.A	NA	NA	--	20,975	13,750	-34
Minas de Gran Bretaña	NA	NA	--	10,820	12,445	15
Cía. Minera del Madrigal	5,185	6,274	21	10,050	12,060	20
Cía. Minera Huaron, S.A	7,595	6,830	-10	NA	NA	--
Cía. Minera Raura, S.A	11,998	9,179	-24	11,720	12,511	7
Cía. Minera Alianza S.A	7,870	7,634	-3	NA	NA	--
Cía. de Minas Buenaventura, S.A	3,856	5,314	38	3,735	4,136	11

NA Not available.

Cía. Minera Milpo, S.A. benefited from the increased ore treating capacity completed in mid-1979. Mine efficiency was also increased to accommodate the new concentrator, which has improved metal recovery and the fine metal content of the concentrates. The company continued work on infrastructural projects. Milpo has a 71% interest in Cía. Promotora de Negocios Mineros "Perú" S.A., which has had encouraging results from exploration at the Colladre polymetallic prospect in Cajamarca. Milpo acquired a 65% interest in the Japanese-owned Cía. Minera Hilarion S.A. An aggressive exploration program has been planned for this lead-zinc-silver deposit located in Huallanca, Department of Huánuco, where ore reserves are estimated at 9 million tons, grading 3% lead, 7% zinc, and 2.5 ounces of silver per ton.

MINERO PERÚ's Cajamarquilla zinc refinery was expected to initiate operations in March 1981. The 101,500-ton-per-year plant is expected to produce about 54,000 tons of high-grade zinc in 1981 and will require at least 200,000 tons of concentrate per year for full capacity production. The bulk of the concentrate will come from small- and medium-sized operators in the central region as well as from CENTROMÍN, whose La Oroya refinery can produce about 75,000 tons of zinc per year. In addition to zinc, the new Cajamarquilla refinery should produce about 350 tons of refined cadmium, 1,650 tons of copper cement, 14,900 tons of lead-silver residues, and 176,000 tons of sulfuric acid per year. This latter product has caused some negative public reaction because of environmental dangers resulting from transport of sulfuric acid to end users. MINERO PERÚ expects to ship about 110,000 tons per year to its Cerro Verde Mine operation in southern Peru, using truck transport as far as Pisco, where it would then go by sea to the Port of Matarani. Sulfuric acid production is also expected to be sold to other mining companies and the export market.

Manganese.—Peru has not reported manganese production since the closure of the Minas de Gran Bretaña operation in 1976. In the near future, Cía. de Minas Buenaventura, S.A., expects to recover manganese compounds from its Uchucchacua silver-lead mine where a lixiviation plant has been planned. Manganese will be recovered as manganese dioxide, ferromanganese, and manganese sulfate. The company anticipated it may take 3 years to complete the metallurgical studies involved. The new

plant is also expected to enhance silver recovery to about 90%.

Molybdenum.—In mid-1980, SPCC completed the installation of its new molybdenum concentrator at Caujone. The immediate visible effect was a doubling of SPCC's molybdenum production to 2,658 tons from 1,182 tons in 1979. Additional tonnage came from small operators such as Cía. Minera Turmalina in northern Peru and Cía. Minera San Diego in the Department of Apurímac, southeast of Lima. Development work planned for 1981 at the San Diego Mine could halve its output that year.

Taminsa, S.A., was exploring the Aries molybdenum deposit located in the District of Chacas, Province of Huari, Department of Ancash. Preliminary work indicated that ore reserves could amount to 220 million tons containing 0.4% to 0.5% molybdenite and some tungsten. A foreign partner may join Taminsa to develop this property, which was estimated to require about $7 million for preliminary development studies.

In northern Peru, another potentially large deposit containing molybdenum along with copper and silver was under study by a Hochschild Group company, Mina de Tamboras, S.A. Reserves were estimated at 100 million tons of ore averaging about 0.16% molybdenite and 20 million tons of combined molybdenum-copper-silver ore.

Silver.—A lower silver content in CENTROMÍN's copper and lead concentrates and labor problems at the La Oroya metallurgical complex reduced the production of silver. This reduction was balanced by a generally increased output from the medium mining section, as shown in table 6.

Table 6.—Peru: Principal producers of silver in ores and concentrates

(Recoverable content in thousands of ounces)

Company	1979	1980	Percent change
CENTROMÍN	10,465	10,235	-2
Cía. de Minas Buenaventura, S.A	3,499	3,498	--
Minas de Arcata, S.A	1,807	1,990	10
Cía. Minera Alianza, S.A	1,580	1,762	12
Cía. Minera Milpo, S.A	1,643	1,740	6
Cía. Minera Huaron, S.A	1,545	1,533	-0.8
Cía. Minera Castrovirreyna, S.A	1,382	1,398	1
Northern Peru Mining Co	1,184	1,245	5
Corp. Minera Castrovirreyna, S.A	1,140	1,243	9
Cía. Minera Caylloma, S.A	606	1,135	87
Cía. Minera Millotingo, S.A	1,033	1,120	8
Cía. Minera Atacocha, S.A	1,039	1,026	-1

Cía. de Minas Buenaventura, S.A., remained the largest private producer of silver from its four units: Julcani and Huachocolpa in the Department of Huancavelica; Orcopampa in Arequipa; and Uchucchacua, located 120 kilometers northeast of Lima. Buenaventura also has an interest in Cía. Minera Colquirrumi (52.5%), Cía. Minera Condesa (92.4%), and Sociedad Minera El Brocal, S.A. (11%), and Cía. Minera Toachi S.A. (33%).

The Hochschild Group, an international enterprise, has long been an active participant in Peruvian mining. The group mines silver from Minas de Arcata, Cía. Minera Pativilca, Cía. Minera Condoroma, Cía. Minera Caylloma, and Cía. Minera Locumba. An aggressive exploration program has been initiated for expanding activities, preferably with Peruvian capital participation.

Hochschild's Arcata Mine is under an expansion program to increase milling capacity to 600 tons per day along with the construction of a 3.8-megawatt hydroelectric plant. At the San Cristóbal Mine, owned by Cía. Minera Caylloma and located in the Department of Arequipa, expansion is planned to increase capacity from 300 to 500 tons per day. Reserves have been estimated at over 4 million tons averaging 8 ounces of silver and 0.016 ounce of gold per ton.

Colquiminas, S.A., which operates the silver-lead-zinc Cacachara Mine between Tacna and Puno in the District of Santa Rosa, Department of Puno, produced 380,000 ounces of silver in 1980. Reserves have been estimated at 1 million tons averaging 12 ounces of silver per ton. The company has been exploring lower levels of this underground mine in an attempt to increase reserves.

The Salpo Mine, located near Quiruvilca in the Department of La Libertad and owned by the Arias Group, was reactivated. A new 200-ton-per-day plant was under

construction to service the Salpo Mine and the new Urumalqui Mine when it starts production in 1982. Urumalqui is located about 15 kilometers east of the Salpo Mine.

The Farallón Mine, owned by Unidad Minera (Arias Group) opened in 1980. Production was about 180 tons of concentrates per month, averaging 26 ounces of silver per ton. A new mill is planned to increase capacity from 80 to 180 tons per day. Improvements toward the recovery of concentrates are also planned.

Cía. Minera Los Andes, S.A., reopened the Sucuitambo Mine, formerly owned by the Hochschild Group and shut down in 1962. The Sucuitambo operation consists of two units, the Nora and the Maria. A 120-ton-per-day mill has been installed. The ore averages 8 to 10 ounces of silver per ton with traces of gold. In 1980, the mine produced 36,000 ounces of silver, but production is expected to increase to 120,000 ounces in 1981.

Tungsten.—In 1980, production from the Pasto Bueno Mine of Fermin Malaga Santolalla e Hijos Negoc. Minera rose above that of CENTROMÍN's San Cristóbal Mine, which continued its downward trend. Pasto Bueno is located in the District of Pampas, Department of Ancash, and has been in operation since 1910. New exploration, high ore grades, plant expansion, the installation of more modern equipment, and a worker incentive program contributed to the company's 54% increase in production over that of 1979 and made it Peru's largest tungsten producer in 1980. Reserves were believed to be sufficient for about 20 years of operation.

Minera Regina, S.A., the third largest tungsten producer, also increased production during 1980. Its concentrate production was almost equal to CENTROMÍN's, although the WO_3 content was lower than CENTROMÍN's.

Production by company in 1979 and 1980 was as follows, in metric tons of WO_3 content:

Company	1979	1980	Percent change
Malaga Santolalla	192	296	+54
CENTROMÍN	403	209	-48
Minera Regina, S.A.	102	145	+42
Small producers	58	50	-14
Total	755	700	-7

NONMETALS

Barite.—Through a loan of $1.5 million from NL Industries Inc.'s Baroid Div., Cesibar, S.A., opened a new barite mine in 1980. The mine, the Santa Cesilia, is located near the Graciela Mine in Huarochirí Province east of Lima. Graciela is owned by Baroid's subsidiary company, Perubar, S.A., and was Peru's major barite producer.

Cement.—The Government reached a financial settlement with Cemento Andino, S.A., over its expropriation of 49% of the 500,000-ton-per-year cement plant at Tarma. The Government was also expected to increase its interest to 49% in the 1-million-ton-per-year Cementos Norte Pacasmayo, S.A., plant. At Cemento Yura, S.A.'s plant in Arequipa, a 1,000-ton-per-day dry process kiln was added with startup scheduled for 1980.

Phosphate.—A new company, Empresa Promotora Bayóvar (PROBAYOVAR), owned by MINERO PERÚ (70%) and two other state agencies, COFIDE and the Empresa Nacional de Comercialización de Insumos, was created in 1980 to study the development of the Bayóvar phosphate deposits in northern Peru. In July, the company received a $7.5 million loan from the World Bank to further study the technology and economic viability of exploiting the deposit, which has ore reserves of 600 million tons and potential resources of up to 10 billion tons. A pilot plant has been constructed as part of the study. The study is also expected to include a determination of whether uranium can be economically extracted from the phosphoric acid. Another study will determine the extent of potash reserves near Bayóvar, which have tentatively been estimated at 8.3 million tons of potassium chloride.

The 1980 production of phosphoric rock decreased at the Bayóvar concentrator because of a 33% decrease in employee working hours. Personnel were diverted to storage yard construction work and also to work for PROBAYOVAR.

MINERAL FUELS

Coal.—MINERO PERÚ was considering new plans for the development of the Alto Chicama coal deposit. Three alternative plans were proposed using production levels of 1, 2, or 3 million tons per year. The proposals included the possibility of pro-

ducing coal for export. The need for market studies added to the factors responsible for delaying the implementation of the project.

At the Jatunhuasi coal deposit, located 45 kilometers northeast of Huancayo, CENTROMÍN has identified 80,000 tons of proven and probable semi-bituminous coking reserves, and inferred reserves of 10 million to 15 million tons. Exploration was to continue in an attempt to locate proven reserves of between 750,000 tons and 1 million tons. CENTROMÍN requested a credit from the United Nations Rotary Fund to finance the exploration and feasibility study. It was reported that CENTROMÍN planned to open up one of the three coal layers so far identified.

Petroleum and Natural Gas.—In July 1980, the Government concluded contract renegotiations with Occidental Petroleum Corp. and Belco Petroleum Corp. in accordance with the December 1979 guidelines governing oil contracts with foreign contractors.

Under the Occidental contract, PETROPERÚ will be the supervisor, title-holder, and owner of all the production in the contract area. Occidental will receive in kind a share of production as compensation for its services. This share will be based on the daily volume and can range from 42% to 50%. The price paid to Occidental for crude, which will be sold domestically in Peru, will vary according to fluctuations in the value of Middle Eastern crudes, while the price of crudes sold to PETROPERÚ for their export market will be set at world prices. Occidental will receive 50% of the total volume of natural gas produced in the contract area. In addition, Occidental agreed to provide training for PETROPERÚ's personnel and to pay PETROPERÚ annually the sum of 1.9 billion soles (about $5 million) for a period of 20 years in order to help the state company in its development of the oil industry.

The new Belco contract provided them with 50% of the total oil produced in the contract area, Block Z-2A. Out of this production share, the company will be responsible for the payment of income taxes directly to the Peruvian Government. Other terms are similar to those agreed by Occidental. Belco also signed an agreement for the sale of natural gas, whereby Belco will receive $1.50 per thousand cubic feet for the first 15 million cubic feet per day, escalating to $3.00 per thousand cubic feet for deliveries exceeding 20 million cubic feet per day. Contract terms for the currently nonproducing Block Z-1A area are similar to those for Block Z-2A, and the Belco Group will share equally with PETROPERÚ in case there is any production in the future. In 1980, Tenneco Oil Co. and Champlin Petroleum Co. withdrew their association with Block Z-2A, leaving Belco as the operator holding 75% and Union Oil Co. with 25%.

Similar negotiations were held with the Occidental-Bridas Exploraciones y Producción of Argentina Group, and an agreement was reached that generally conformed to the Occidental and Belco contracts. In addition, the Occidental-Bridas contract included the agreement to form a new company, Petrolera Latinomericana (PETROLATINA), to exploit the partnership's recovery program in the Talara north coastal block. Ownership of PETROLATINA was defined as Occidental 49%, Bridas 25%, and PETROPERÚ 26%. The Occidental Group became a service contractor, receiving a fee on all petroleum produced instead of sharing 49% of the increased output resulting from the program. The group will pay Peruvian income taxes on the fees earned. The fee can escalate in line with a formula involving Middle Eastern oil prices. However, by the end of 1980, no action had been taken to form the new company, and the project continued as before with Occidental holding 84% of the equity and Bridas 16%, and 51% of production sold to PETROPERÚ.

Waterflooding operations began in August 1980 in the Talara area. Occidental drilled more than 288 wells in this area during 1980. Since the project began in 1978, Occidental has drilled more than 600 wells at Talara. During this period, no secondary recovery crude has been lifted, but new primary output has increased production from 6,000 barrels per day to 17,700 barrels per day.

Occidental's northeastern jungle fields continued to produce at near the capacities of the spur line, the Trans-Andean Pipeline, and the river barge fleet. In 1980, 12 jungle fields in which Occidental held a 50% interest produced about 106,000 barrels per day. Occidental has drilled a total of 210 wells in this area since 1977, and exploration efforts in 1980 resulted in extensions to the San Jacino and Dorissa Fields. A wildcat was also drilled in the Tigre prospect.

Peru's total estimated 1980 crude oil production, in barrels per day, by company, was as follows:

Company	1979	1980
PETROPERÚ	51,184	43,960
Occidental	106,180	105,885
Belco	28,329	27,984
Occidental-Bridas	5,957	17,702
Total	191,650	195,531

In 1980, a $32.5 million loan was received from the World Bank to finance the major part of a 3-year program to improve production capabilities of PETROPERÚ's jungle and northwest coastal operations. Improvements included the installation of 35 pumps in the northern jungle fields, pumping systems to reactivate primary production from the coastal fields; a study on a secondary recovery project for the Brea-Pariñas coastal area; seismic surveys; and consultant services.

PETROPERÚ opened new areas in the jungle for exploration and several agreements were under negotiation during 1980. The first contract basis agreement—considered a preliminary step for the later signing of an operations contract—was signed in October with Royal Dutch/Shell. This agreement covered Blocks 38 and 42 in the southeastern jungle region in the Alto Ucayali and Madre de Dios Basins below latitude 7° S. It was reported that Shell has planned to initially invest $100 million in the project. Final agreement remained dependent on negotiations regarding production split, taxes, and other matters.

The Superior Oil Co. and Petrolera General S.A., a subsidiary of Phoenix Canada Oil Co., Ltd., were negotiating for exploration rights to Block 2, which consists of about 2.5 million acres in the northeastern jungle south of Occidental's Block 1-A and east of the Río Santiago. Final agreements with both the Shell and Superior groups were expected early in 1981.

At least 14 other companies have expressed an interest in initiating negotiations with PETROPERÚ for exploration or secondary recovery projects. Among those mentioned were Husky Oil Co., Mapco, Allied Chemical Corp., C and K Petroleum, Conoco, Mobile, Gulf, Elf-Aquitaine, Petroleos Brazileira S.A., Cities Service, Sun Oil Co., Phillips Petroleum Co., Coastal State, Marathon Oil Co., British Petroleum Co., and two local companies, Petroinca and Petroleos del Norte S.A.

The late 1980 changes in the petroleum law and the forthcoming implementing regulations are expected to influence final investment decisions by Shell and other interested companies.

Uranium.—The Instituto Peruano de Energía Nuclear announced that rich uranium deposits were located north of Lake Titicaca near the Bolivian frontier. Geological indications of uranium were also reported near Oxapampa in Pasco Department.

Decree Law 23112 of 1980 governs investment in the mining of radioactive minerals. It provides guarantees concerning the remittance of profits abroad, tax exemptions, and stability until the year 2010. Foreign participation in the exploration and exploitation of uranium was indicated as being acceptable with the restriction that those areas of highest potential are reserved for the Government.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Peruvian soles (S) to U.S. dollars at the 1980 average exchange rate of S288.13 = US$1.00.

The Mineral Industry of the Philippines

By John C. Wu[1]

The Philippines economic performance as measured by the growth of real gross national product (GNP) in 1980 was not so remarkable as that of other resource-rich Southeast Asian countries, such as Malaysia, and Indonesia. Its 4.7% increase in real GNP was considered better than advanced industrial nations in the Western World affected by world inflation, recession, and a series of oil price increases. The country's output performance as measured by real gross domestic product (GDP) managed to advance a modest growth of 5.2% in 1980. However, by industry sector, real gross value added by mining and quarrying increased 10.1% in 1980, second only to the smallest but fast-growing electricity, gas, and water sector, which registered a 16.4% in real growth.

In 1980, the mining and quarrying sector contributed US$315 million[2] in 1972 constant dollars to the country's GDP of US$12,325 million in 1972 constant dollars.

Despite its relatively small contribution to the country's GDP, the mining industry remained an important sector of the Philippines economy. In 1980, the Philippines remained 1 of the top 10 world producers of copper and gold. Other important metallic mineral commodities produced by the country were nickel, cobalt, chromium, and silver. The industry's output of copper, gold, and nickel were among the top 10 foreign exchange earners, which have generated a substantial amount of foreign exchange compensating for the growing import bills of crude petroleum and capital goods. The mining and quarrying industry was also one of the fast-growing sectors among the Philippines major industry sectors in terms of the real gross-value-added for the past years.

Five major industrial projects related to the mining sector were started in 1980. A joint venture agreement between the Government of the Philippines and Reynolds Aluminum Co. of the United States was signed in February 1980 to build a $460 million aluminum smelter with an annual capacity of 140,000 tons in Misamis Oriental, on the Island of Mindanao, to be completed in 1985. Construction of the Philippines first $250 million copper smelter started at Isabel of southern Leyte in August 1980. The owner and operator of the smelter chose a Japanese consortium composed of Marubeni Corp., Sumitomo Corp., and C. Itoh & Co., as its major foreign partner. The project is expected to be completed in 1983 with an initial output of 138,000 tons per year of refined copper, 195,000 ounces of gold, 850,000 ounces of silver, and other byproducts such as selenium and sulfuric acid. A joint venture agreement between the Philippines and West German concerns was finally approved by the Philippines Board of Investment to start a $40.2 million iron ore mining and milling project in Antipolo Rizal by yearend 1980. The proposed plant would have an annual capacity of 1.5 million tons of iron ore concentrate for export by 1984. Under the Philippines cement industry rationalization program, the first of five 1-million-ton-per-year, coal-fired cement plants was started by Negros Cement Corp. at Basay, Negros Oriental, in June 1980, and a $33.3 million contract was awarded to Krupp Polysius A.G. of the Federal Republic of Germany to convert nine oil-fired cement plants to coal in the Philippines in November 1980. The Philippines has selected Isabel of Leyte Island as its first phosphatic fertilizer plant site and invitation-to-bid papers were sent

to four consortiums in August 1980. The estimated $370 million fertilizer project was expected to start in the spring of 1981 and be completed by February 1983. Upon completion of the project, the complex would have a sulfuric acid plant, a phosphoric acid plant, a granulation plant, and an ammonium sulfate plant. The planned output capacity of phosphatic fertilizer is 350,000 tons per year. A joint venture agreement between the Government of the Philippines and Billiton International Metals B.V., a wholly owned subsidiary of Royal Dutch/Shell, was signed in September 1980 to create an investment firm. The $100 million joint venture investment company will be involved in various domestic mining projects, which include mining of copper, zinc, lead, nickel, tin, tungsten, molybdenum, chromium, and associated nonferrous metals. Under the agreement, the National Development Co. (NDC) would hold 60% equity of NDC-Shell Mineral Investment Co., and the remaining 40% would be held by Billiton B.V.[3]

The Philippines has made significant progress in coal production as well as in exploration. However, the country suffered a major setback in 1980 when the output of the offshore Nido Oilfield, the country's only active oilfield, northwest of Palawan Island, dropped drastically from the peak level of 40,000 barrels per day in September 1979 to 10,000 barrels per day in mid-1980 and down to 3,500 to 4,500 barrels per day by yearend 1980.

During 1980, the Government of the Philippines issued four new laws related to the country's mining sector. On February 19, 1980, the President of the Philippines issued a new decree No. 1677, which states that "in case the foreign service contractor or another foreign company holds equity in the local mining corporations involved in the service contract, the equity participation including the service fee shall in no case exceed 40% of the net proceeds of the operations before tax."[4] These are among the terms and conditions set forth by new regulations for the approval of service contracts for the exploration, development, exploitation, and utilization of mineral resources. On March 11, 1980, the President issued Executive Order No. 581, to reimpose a 4% basic export tax and a 40% premium duty (up from 10%) on gold, silver, copper ore and concentrate, and refractory chromite. But the President suspended the order on March 27, 1980, until a mutually acceptable formula was worked out by the Government and industry. On August 1, 1980, Executive Order No. 609 was issued by the President. The executive order, effective January 1, 1981, provides the latest modification of the Philippines tariff schedule, to be implemented in up to five stages over the next 5 years, which will reduce the tariff on many imports. The minimum tariff rate in general is 10% for producer goods not available locally, and 5% for certain critical raw materials needed by the country's various manufacturing industries.[5] On September 18, 1980, a new decree called Batas Pumbansa No. 84 and Presidential Decree 1924, were signed by President Marcos. Under Batas Pumbansa No. 84, the royalty taxes (ad valorem) on minerals and mineral products will raise from 1.5% to 2% on the actual market value of gross output to 5% on such products as gold, silver, and copper. The accompanying Presidential Decree No. 1924 gave the President the power to revise the rates of taxes and classifications of mineral products, as well as to prescribe the rates to tax in the case of marginal mines, which require protection, assistance, and incentives.[6]

PRODUCTION

The Philippines overall mineral production, in terms of the value of preliminary estimated output, increased 33.3% in 1980 over that of 1979. Of the total minerals produced in the Philippines, the following commodities registered a gain in the output value of 1980: Gold increased 42%; silver, 83%; cobalt, 2.7%; copper, 42%; nickel, 46.9%; bentonite, 30.3%; cement, 27.1%; coal, 15%; silica sand, 24.2%; and sand and gravel, 20.0%. The commodities that registered a drop in the output in 1980 were lead, decreased 28% in value; molybdenum, 59.9%; zinc, 30.6%; metallurgical chromium ore, 53.9%; and unwashed manganese ore, 40.2%. The main reasons for increased minerals output were various new mines came onstream in 1980, some old mines were rehabilitated, and various mining and milling capacities were expanded as a result of higher world commodity prices. Those commodities that suffered a decline in output mainly resulted from declining ore grade, breakdown of machinery and equipment, as

well as depressed market prices. The Philippines only oil output was from its Nido Oilfield. The oil flow dropped sharply from 40,000 barrels per day in September of 1979 to 3,500 to 4,500 barrels per day by yearend 1980. According to Cities Service, the operator of the Nido Oilfield, and the Ministry of Energy, the Nido Oilfield is approaching exhaustion.

Table 1.—Philippines: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Chromium: Chromite, gross weight:					
Metallurgical grade	120,761	136,173	141,048	167,785	[3]132,923
Refractory grade	310,302	[r]402,376	398,850	388,325	[3]392,208
Total	431,063	[r]538,549	539,898	556,110	[3]525,131
Cobalt, mine output, metal content	492	1,084	1,192	1,370	[3]1,514
Copper, mine output, metal content	[r]237,588	272,792	263,590	298,300	[3]323,485
Gold, troy ounces	501,210	[r]558,554	586,531	535,166	[3]589,965
Iron and steel:					
Iron ore and concentrate, thousand tons	571	--	2	6	--
Ferroalloys: Electric-furnace ferrosilicon[e]	7,500	15,000	14,000	18,000	20,000
Crude steel, thousand tons	393	364	276	397	[3]420
Lead, mine output, metal content	4,530	3,695	1,448	1,949	[3]1,596
Manganese ore and concentrate, gross weight	10,576	20,599	3,911	3,769	[3]1,966
Molybdenum, mine output, metal content	--	--	55	141	[3]58
Nickel:					
Mine output, metal content	[r e]15,239	36,781	29,528	33,287	[3]38,280
Metal, smelter	15,239	21,873	18,737	21,478	25,200
Silver, mine output, metal content, thousand troy ounces	1,481	1,621	1,640	1,838	[3]2,114
Zinc, mine output, metal content	11,643	12,442	9,468	9,670	[3]7,260
NONMETALS					
Asbestos	--	--	159	--	NA
Barite	3,199	5,393	5,548	6,667	6,200
Cement, hydraulic, thousand tons	[r]4,149	[r]4,197	4,340	3,950	[3]4,247
Clays:					
Bentonite	2,117	2,279	1,569	3,123	[3]4,758
Red	8,284	18,737	12,271	24,126	24,000
White	13,159	11,854	7,040	402,241	400,000
Rock	1,498	913	373	1,393	1,400
Other	[r]475,154	[r]411,568	502,241	428,639	420,000
Feldspar	15,240	[r]16,073	18,073	16,848	17,500
Gypsum and anhydrite:					
Natural	2,820	1,710	[e]1,700	--	--
Synthetic[e]	115,000	110,000	110,000	110,000	110,000
Lime	27,086	28,184	33,317	53,877	54,000
Nitrogen: N content of ammonia	[r e]40,000	[r e]40,000	[r e]40,000	40,400	39,100
Phosphate:					
Guano	1,757	162	821	3,158	3,200
Phosphate rock	11,923	10,323	1,074	2,494	2,600
Perlite	1,649	1,864	3,168	3,806	4,000
Pyrite and pyrrhotite (including cuprous), gross weight	166,331	108,523	110,774	87,408	100,000
Salt, marine	203,386	200,000	225,650	322,131	350,000
Sand and gravel:					
Alumina sand	12,601	18,040	31,414	26,547	30,000
Silica sand, thousand tons	391	[r]311	419	407	400
Other[4], thousand cubic meters	6,113	7,347	9,964	11,132	12,000
Stone:					
Andesite	--	420,000	8,461	276,221	NA
Basalt, cubic meters	--	--	--	421	NA
Coral, do	5,674	14	40	--	NA
Dacite	12,680	20,224	18,841	18,136	19,000
Diorite	105,835	97,841	90,128	112,319	120,000
Dolomite	6,432	7,442	7,600	10,375	12,000
Limestone[5], thousand tons	6,944	[r]6,393	9,432	10,152	11,000
Marble (dimension), unfinished, cubic meters	4,140	[r]5,750	8,692	5,954	7,000
Volcanic cinder, do	NA	NA	346,235	827	NA
Sandstone	75,005	67,612	91,337	47,006	60,000
Serpentine	NA	NA	2,571	7,579	NA
Tuff	77,123	58,574	90,493	106,327	120,000
Quartz	[e]15,000	[e]30,000	28,190	39,298	45,000
Crushed, broken, other[6], thousand cubic meters	2,133	1,572	4,066	1,908	NA

See footnotes at end of table.

Table 1.—Philippines: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Sulfur, S content of pyrite	77,344	50,463	51,510	40,645	46,500
Talc	1,411	1,200	4,061	3,570	4,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades	120,810	284,554	255,054	263,132	[3]276,200
Petroleum:					
Crude thousand 42-gallon barrels	--	--	--	8,570	[3]3,620
Refinery products:					
Gasoline do.	15,381	15,234	14,423	14,632	[3]11,751
Jet fuel do.	2,353	2,665	2,684	2,174	[3]2,270
Kerosine do.	2,991	3,110	3,516	4,055	[3]3,620
Distillate fuel oil do.	14,148	15,021	14,966	16,532	[3]17,204
Residual fuel oil do.	25,149	27,244	29,500	29,278	[3]27,333
Other do.	3,118	2,959	2,542	3,002	[3]3,421
Refinery fuel and losses do.	3,314	3,639	4,195	3,536	[3]3,203
Total do.	66,454	69,872	71,826	73,209	[3]68,802

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 10, 1981.

[2]In addition to the commodities listed, the Philippines produces platinum-group metals as byproducts of other metals, but output is not reported quantitatively and no basis is available to make reliable estimates of output levels.

[3]Reported figure.

[4]Includes "pebbles" and "soil," not further described.

[5]Excludes limestone for road construction, reported in cubic meters, which totaled 9,687 cubic meters in 1978 and 2,932 cubic meters in 1979 (other years not available).

[6]Includes materials described as "rock, crushed or broken," "stones, cobbles, and boulders," "rock aggregates," and "broken adobe."

TRADE

In 1980, the Philippines total export earnings were valued at $4.64 billion, a 22.8% increase from $3.78 billion for 1979. Total imports were valued at $6.39 billion, a 15.3% increase from $5.54 billion for 1979. The resulting negative balance of $1.75 billion for 1980, however, represents only a slight improvement from the $1.76 billion merchandise trade deficit recorded in 1979. This was due mainly to larger import bills that arose from the higher prices of crude oil and capital goods.

Copper, gold, and nickel were among the Philippines top 10 foreign exchange earners along with sugar, coconut oil, garments, lumber, bananas, and electric and electronic equipment and parts. In 1979, copper exports, valued at $481.2 million, accounted for 12.7% of total export earnings; gold exports, valued at $104.6 million, accounted for 2.8%; nickel exports, valued at $99.6 million, accounted for 2.6%; cobalt exports, valued at $51.2 million, accounted for 1.4%; and refractory chromite ore exports, valued at $22.3 million, accounted for 0.6%. The main copper importing countries were Japan, which accounted for 75%; South Korea, 10%; and the United States, 6%. The main purchasers of gold were Japan, accounting for 69%; the United States, 16%; and South Korea, 9%. The major buyers of nickel were the United States, accounting for 31%; Japan, 30%; and the Netherlands, 28%. Of the total cobalt exported, 98% was shipped to Japan. In 1980, the configuration of export destination for the major metallic minerals remained substantially the same as in 1979.

Mineral fuels, machinery other than electric, base metal (iron and steel) transport equipment, materials for the manufacture of electrical and electronic machinery, and chemical elements and compounds were among the top 10 principal imports of the Philippines in 1979. The imports of these six major items were valued at $4.0 billion, and accounted for over 70% of the value of overall merchandise imported by the Philippines in 1979. The main suppliers of principal imports in 1979-80 were Japan, the United States, the European Economic Communities, and the Middle East countries.

During 1979-80, the major trading partners of the Philippines, based on the value of two-way trade, were the United States, Japan, the European Economic Communities, and Middle East countries (mainly Saudi Arabia and Kuwait).

Table 2.—Philippines: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	--	1,050	--	Hong Kong 850; Taiwan 200.
Semimanufactures	1,894	924	--	Hong Kong 652; Indonesia 76; Malaysia 76.
Chromium:				
Chromite	402,247	304,952	123,849	Japan 91,922; Netherlands 16,000; China, mainland 15,525.
Concentrate	53,434	191,818	29,098	Japan 112,040; China, mainland 18,880; Brazil 11,800.
Copper:				
Ore and concentrate thousand tons	895	1,048	58	Japan 797; Republic of Korea 111; Taiwan 39; U.S.S.R. 20.
Metal including alloys:				
Scrap	1,270	792	--	Japan 498; Taiwan 198; India 66; Belgium 19.
Matte	8	10	--	All to Japan.
Unwrought and semimanufactures kilograms	--	845	--	All to Hong Kong.
Gold:				
Metal in copper ore and concentrate troy ounces	411,169	367,211	62,738	Japan 258,597; Republic of Korea 21,158; Taiwan 15,305.
Bullion do	1,227	--		
Iron and steel:				
Ore and concentrate thousand tons	3,280	4,100	--	Japan 4,018; Taiwan 82.
Roasted pyrite	54,992	33,079	--	All to Taiwan.
Metal including alloys:				
Scrap	2,749	2,530	--	Taiwan 1,315; Japan 1,157.
Pig iron and similar materials	4	23	--	All to Republic of Korea.
Ferroalloys:				
Ferrosilicon	11,398	10,117	--	Japan 8,222; Indonesia 1,232; Thailand 522.
Other	756	1,021	--	Japan 1,011; Australia 10.
Semimanufactures:				
Bars, rods, angles, shapes, sections	227	283	--	Guam 282.
Universals, plates, sheets	51,414	78,195	3,788	Taiwan 39,127; Thailand 22,574; Indonesia 8,636.
Hoop and strip	396	2,950	--	All to Malaysia.
Wire	--	25	--	All to Japan.
Tubes, pipes, fittings	151	2,808	--	Australia 1,998; Singapore 404; France 339.
Castings and forgings, rough	517	905	746	Australia 156; Singapore 3.
Lead, ore and concentrate	2,268	5,574	--	All to Japan.
Manganese ore and concentrate	7,715	7,383	--	Taiwan 5,396; Japan 1,987.
Molybdenum ore and concentrate	41	210	44	West Germany 152; Netherlands 14.
Nickel:				
Ore and concentrate	578,034	704,299	--	All to Japan.
Metal including alloys:				
Scrap	85	--		
Unwrought	12,016	14,791	5,332	Netherlands 5,470; Japan 1,742; Romania 1,556.
Semimanufactures	1,166	2,416	1,005	Japan 900; Canada 332; Netherlands 179.
Silver metal including alloys, unworked and partly worked:				
Silver, including silver gilt and platinum-plated silver troy ounces	16,464	168,195	--	Hong Kong 166,196; Switzerland 1,999.
Rolled do	--	5,370	--	All to Hong Kong.
Tin metal including alloys, waste and scrap	21	403	33	Indonesia 294; Japan 70; Hong Kong 6.
Tungsten metal including alloys, waste and scrap kilograms	--	393	393	
Zinc:				
Ore and concentrate	16,126	22,295	3,277	Japan 19,018.
Metal including alloys:				
Scrap	--	305	--	Japan 270; Taiwan 20; Singapore 15.
Blue powder	40	--		
Semimanufactures	--	15	--	All to Hong Kong.
Other: Ash and residue containing nonferrous metals	2,291	1,949	11	Japan 982; Taiwan 784; Singapore 93.
NONMETALS				
Abrasives:				
Emery, pumice, natural corundum, etc	17	--		
Grinding and polishing wheels and stones kilograms	--	6	--	All to Indonesia.
Asbestos do	250	--		

See footnotes at end of table.

Table 2.—Philippines: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Cement	786,866	291,580	--	Hong Kong 103,957; Thailand 87,261; Brunei 28,245; Malaysia 23,161.
Chalk kilograms	--	160	--	All to Thailand.
Clays and clay products including all refractory brick:				
Crude clay:				
Kaolin	49	--		
Other	196	23	--	All to Australia
Products:				
Nonrefractory value, thousands	$4,097	$4,748	$685	Singapore $997; West Germany $938; Hong Kong $525.
Refractory do	--	$2,300	--	All to Taiwan.
Diamond, industrial carats	600	--		
Fertilizer materials:				
Manufactured, mixed	2,512	(1)	--	All to Indonesia.
Ammonia	4	11	--	All to Hong Kong.
Gypsum and plasters kilograms	129	--		
Lime	7	--		
Pyrite	29,880	6,732	--	All to Japan.
Salt kilograms	227	544	544	
Sodium and potassium compounds, n.e.s.:				
Caustic potash do	450	410	410	
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	218	571	16	Japan 459; Taiwan 95.
Other	300	3	--	All to Taiwan.
Worked:				
Marble	1,527	1,533	460	Japan 664; Hong Kong 263.
Other	33	--		
Gravel and crushed stone	1,369	1,383	1	Japan 1,300; Hong Kong 50.
Limestone flux	22,500	71,622	--	All to Australia.
Sand:				
Natural (river and sea)	856	1,182	113	Japan 357; United Kingdom 275; Hong Kong 113.
Other	58	--		
Dolomite, unworked and partly worked	3,150	--		
Sulfur: Sulfuric acid, oleum	82	147	--	Guam 141; Hong Kong 6.
Other nonmetals, n.e.s.:				
Slag, dross, waste, not metal-bearing:				
From iron and steel manufacture	776	3	--	All to United Kingdom.
Other	--	24	--	All to West Germany.
Halogens, chlorine kilograms	--	400	--	All to Guam.
Activated mineral products, natural	258	2,273	--	India 1,535; Australia 289; Malaysia 220.
Mineral substances, n.e.s	4,906	3,868	--	Brunei 2,585; Taiwan 1,276.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	18	--		
Carbon black	1,152	2,145	--	Thailand 1,036; India 551; Taiwan 478.
Coal, briquets	--	44	--	All to Japan.
Petroleum refinery products:[2]				
Gasoline:				
Aviation 42-gallon barrels	--	13,202	--	NA.
Motor do	241,902	90,972	--	French Pacific Islands 76,999.
Kerosine and jet fuel do	66,000	8,704	--	NA.
Distillate fuel oil do	161,797	183,926	--	Hong Kong 120,126.
Residual fuel oil do	--	93,355	--	Hong Kong 93,337; Singapore 18.
Lubricants do	--	21,006	--	Thailand 11,560; Republic of Korea 5,905; Tanzania 1,315.
Other:				
Liquefied petroleum gas do	--	13,050	--	All to Hong Kong.
Mineral wax do	--	2	--	All to Singapore.
Bitumen and other residues do	--	22	--	All to Hong Kong.
Total do	469,699	424,239		

NA Not available.
[1]Less than 1/2 unit.
[2]Excludes bunker loadings.

Table 3.—Philippines: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina	1,550	2,743	187	Japan 1,925; China, mainland 500.
Bauxite	4,112	9,909	6	Malaysia 8,903; China, mainland 1,000.
Metal including alloys:				
Scrap	33	38	22	West Germany 16.
Unwrought	16,790	28,412	2,726	Australia 14,296; Japan 3,940; France 2,782; Bahrain 2,742.
Semimanufactures	4,347	6,948	463	Japan 3,161; Norway 864; Sweden 689; West Germany 683.
Arsenic trioxide, pentoxide, acids	152	246	(1)	United Kingdom 118; Belgium 70; France 53.
Chromium:				
Ore and concentrate—kilograms	--	500	--	All from Japan.
Oxide and hydroxide—do	138	85	21	West Germany 50; Belgium 12.
Cobalt oxide and hydroxide	2,220	1,258	--	West Germany 1,058; Belgium 200.
Copper:				
Copper sulfate	146	185	1	New Zealand and Western Samoa 135; Australia 24.
Metal including alloys:				
Scrap	6	--		
Unwrought	6,462	5,273	107	Japan 3,188; Australia 751; United Kingdom 348; West Germany 300.
Semimanufactures	4,577	4,994	272	Japan 3,268; Australia 625.
Gold metal including alloys:				
Unwrought or semimanufactures—troy ounces	69	165	165	
Rolled-on base metal or silver—do	143	2,967	2,967	
Iron and steel:				
Ore and concentrate—thousand tons	3,405	3,363	--	Australia 1,800; Brazil 1,192.
Metal including alloys:				
Scrap	79,282	95,465	68,882	Japan 12,555; Australia 12,005.
Pig iron, cast iron, powder, shot	35,780	45,567	143	Brazil 23,105; East Germany 19,961; Australia 1,293.
Ferroalloys:				
Ferromanganese	2,936	5,537	--	Australia 2,000; Japan 1,169; Taiwan 995; India 798.
Ferrosilicon	262	177	61	Taiwan 100; United Kingdom 16.
Others	694	1,309	30	Mozambique 750; Japan 200; India 130.
Steel, primary forms	555,430	669,195	35	Japan 241,529; Australia 171,200; Republic of Korea 103,823.
Semimanufactures:				
Bars, rods, angles, shapes, sections	82,982	78,554	433	Japan 45,262; Taiwan 11,261; Australia 11,085.
Universals, plates, sheets	277,752	371,824	4,412	Japan 337,776; Republic of Korea 8,072; Hong Kong 6,480.
Hoop and strip	20,731	11,539	196	Japan 6,833; Mozambique 1,634; Australia 1,307.
Rails and accessories	3,067	10,059	32	Japan 8,957; India 436; West Germany 412.
Wire	14,587	16,924	94	Japan 6,901; Republic of Korea 3,823; Taiwan 2,575.
Tubes, pipes, fittings	37,591	40,019	5,331	Japan 30,685; Australia 911; West Germany 894.
Castings and forgings, rough	1	21	--	Taiwan 19; Japan 2.
Lead:				
Oxides	57	494	16	Australia 466; Belgium 10.
Metal including alloys:				
Scrap	107	929	197	Australia 632; Oman 100.
Unwrought	7,698	7,648	326	Australia 5,194; Japan 532.
Semimanufactures	346	369	41	Australia 175; Japan 53; West Germany 47.
Magnesium metal including alloys, all forms	26	35	5	Japan 30.
Manganese:				
Ore and concentrate	6,982	3,456	--	Zaire 2,679; Singapore 414; Japan 338.
Oxides	1,612	1,445	12	Japan 1,004; India 300; Netherlands 70.
Mercury—76-pound flasks	755	335	116	Japan 110; Spain 100; France 7.
Molybdenum metal including alloys, all forms	60	71	(1)	United Kingdom 51; West Germany 20.
Nickel:				
Ore and concentrate	18,029	--		
Metal including alloys, all forms	174	164	25	Australia 41; Japan 22; Norway 14.
Platinum-group metals, unwrought and semimanufactures—troy ounces	15,069	6,915	5,223	Japan 1,660.
Silver metal including alloys:				
Silver leaf and silver foil—do	--	32	32	
Other, including gilt and platinum-plated, unwrought and semimanufactures—do	99,066	90,182	51,246	West Germany 33,116; Japan 2,199.
Tin:				
Oxide	509	1,130	1,130	
Metal including alloys, all forms	776	488	14	Malaysia 245; West Germany 130; Singapore 46.
Titanium:				
Ores (rutile and ilmenite)	726	493	--	All from Australia.
Oxide and hydroxide	2,842	2,585	47	West Germany 829; Australia 593; Japan 499.

See footnotes at end of table.

Table 3.—Philippines: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tungsten metal including alloys, all forms kilograms	2,094	1,478	168	Belgium 640; Canada 390; New Zealand 150.
Zinc:				
Oxide and peroxide	615	1,090	92	Taiwan 395; Australia 228; India 172.
Metal including alloys:				
Unwrought	27,095	26,550	389	Canada 10,529; Australia 7,064; Japan 4,740.
Semimanufactures	254	578	169	Japan 363; West Germany 18.
Zirconium ore and concentrate	28	383	--	Japan 284; Australia 99.
Other, n.e.s.:				
Ores and concentrates	12	120	--	Australia 70; Japan 49.
Oxides, hydroxides, peroxides	395	446	118	Taiwan 90; Japan 78; United Kingdom 50; West Germany 40.
Base metals including alloys, all forms	28	78	(1)	Hong Kong 48; Australia 14; China, mainland 10.
Ash and residue containing nonferrous metals	18,774	68,658	26	Japan 68,630; Australia 2.
Metalloids	25	28	(1)	Japan 17; Sweden 8.
Alkali, alkaline earths, rare-earth metals	2	8	6	United Kingdom 1.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, natural corundum, etc	1,051	1,187	105	India 398; Greece 321; Spain 209.
Dust and powder of precious and semi-precious stones kilograms	5	22	11	Belgium 10; Japan 1.
Grinding and polishing wheels and stones	922	1,160	119	Taiwan 209; Brazil 195; Japan 188.
Manufactured: Artificial corundum	149	125	8	Japan 79; Republic of Korea 20; West Germany 18.
Asbestos	4,822	6,570	96	Canada 5,091; Australia 1,134.
Barite and witherite	1,169	1,054	569	Singapore 454; Taiwan 30; Japan 1.
Boron materials, oxide and acid	599	696	672	China, mainland 20; West Germany 3.
Cement	7,329	21,027	2,629	Japan 14,535; Singapore 2,726; China, mainland 1,000.
Chalk	36	20	--	All from Japan.
Clays and clay products including all refractory brick:				
Crude clays, n.e.s.:				
Bentonite and fuller's earth	9,663	10,258	8,117	Singapore 1,260; Italy 500; Japan 381.
Fire clay	1,420	1,366	95	Japan 906; China, mainland 266; United Kingdom 71.
Kaolin (china clay)	9,107	9,441	3,456	United Kingdom 2,353; Japan 2,184; Republic of Korea 600.
Other	10,290	15,458	12,162	Singapore 2,238; Japan 632; France 252.
Products:				
Refractory including nonclay brick value, thousands	$9,036	$9,966	$1,888	Japan $3,618; United Kingdom $1,218; Austria $1,054.
Nonrefractory do	$340	$513	$21	Italy $247; Japan $127; West Germany $90.
Diamond, industrial carats	76,733	84,110	--	Australia 33,010; Belgium 20,500; United Kingdom 17,500.
Diatomite and other infusorial earth	1,715	1,451	1,262	Japan 189.
Feldspar and fluorspar	2,940	3,354	5	India 1,056; China, mainland 697; Thailand 651.
Fertilizer materials:				
Crude:				
Nitrogenous	--	30	--	All from Japan.
Phosphatic	21,766	96,632	90,602	Australia 5,980; Japan 50.
Manufactured:				
Nitrogenous	345,467	503,237	25,296	Republic of Korea 170,515; Japan 108,918; Indonesia 73,831.
Phosphatic	6,002	77,952	50,899	Republic of Korea 27,050.
Potassic	9,939	107,491	71,122	U.S.S.R. 21,915; West Germany 6,102; Israel 4,000.
Other including mixed	1,117	38,366	16	Republic of Korea 14,000; Finland 13,500; Japan 10,717.
Ammonia	272,995	200,193	22	Japan 200,164.
Graphite, natural	160	291	3	Republic of Korea 102; Sri Lanka 50; Italy 38; Austria 34.
Gypsum and plasters:				
Gypsum	82,935	57,255	55	Japan 41,513; Australia 15,682.
Plasters	5,279	6,019	52	West Germany 5,678; Japan 203.
Lime	373	306	157	United Kingdom 136; Japan 10; India 3.
Magnesite	1,261	3,913	--	Japan 2,322; China, mainland 1,255; West Germany 108.
Mica:				
Crude including splittings and waste	86	61	31	India 18; Switzerland 6.
Worked including agglomerated splittings	22	22	1	India 13; Netherlands 2.

See footnotes at end of table.

Table 3.—Philippines: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Pigments, mineral:				
Natural, crude	3,274	3,586	57	India 2,253; United Kingdom 1,238.
Iron oxides, processed	1,180	1,615	56	West Germany 978; Spain 230; Japan 143; United Kingdom 132.
Salt	45,261	63,989	79	Australia 60,938; West Germany 1,569.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	39,114	27,567	11,775	France 7,672; West Germany 1,973; Poland 1,842.
Caustic potash	453	860	174	Japan 423; Italy 122.
Sodium carbonate	69,269	81,554	24,455	Kenya 23,481; Japan 23,363; West Germany 8,256.
Stone, sand and gravel:				
Dimension stone, crude and worked	702	1,025	--	Taiwan 671; Hong Kong 322; Italy 22.
Dolomite	7,804	9,867	--	Japan 5,736; Taiwan 2,066; United Kingdom 950.
Gravel and crushed stone	190	242	32	France 167; Japan 43.
Limestone, except dimension	1,726	960	--	Japan 690; Singapore 109; Republic of Korea 57.
Quartz and quartzite	228	317	2	Republic of Korea 229; Sweden 47; Netherlands 19.
Sand:				
Natural (river and sea)	--	18	18	
Silica	18,079	17,066	75	Malaysia 15,446; Australia 1,393.
Other	209	2,328	68	Taiwan 1,894; Australia 278; Italy 38.
Sulfur:				
Elemental, all forms	24,559	18,141	2,842	Canada 9,603; Japan 5,090.
Sulfur dioxide	60	58	23	Canada 35.
Sulfuric acid, oleum	77,183	87,963	20	Japan 87,778; Taiwan 110.
Talc	8,546	7,148	1,014	Republic of Korea 5,147; China, mainland 530.
Other nonmetals, n.e.s.:				
Crude	1,094	279	--	Australia 100; Japan 73; Sweden 71.
Slag, dross, and similar waste, not metal-bearing	35,171	88,790	5	Japan 87,781; China, mainland 800.
Oxides, hydroxides, and peroxides of barium, magnesium, strontium	553	3,173	137	Japan 2,637; Australia 179; Netherlands 148.
Bromine, iodine, fluorine, chlorine	2	42	2	West Germany 40.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,035	941	41	Republic of Korea 900.
Carbon black and gas carbon	1,286	1,240	523	Japan 486; Australia 161; West Germany 64.
Coal and briquets:				
Anthracite and bituminous coal	51,540	1,388	593	Japan 715; Taiwan 80.
Briquets of anthracite and bituminous coal	--	68	--	All from Japan.
Lignite and lignite briquets	45	366	122	Hong Kong 244.
Coke and semicoke of coal and lignite	242,328	267,695	6	Japan 188,904; Australia 77,286; Taiwan 1,499.
Gas, natural—thousand cubic feet	227	1,478	(1)	Kuwait 1,332; Japan 146.
Hydrogen, helium, rare gases	106	198	7	Japan 165; Singapore 11.
Peat including peat briquets and litter	189	3	--	Mainly from Norway.
Petroleum and refinery products:				
Crude and partly refined—thousand 42-gallon barrels	73,653	67,100	--	Saudi Arabia 22,601; Kuwait 10,650; Iraq 10,413.
Refinery products:				
Gasoline:				
Aviation—do	53	193	--	Netherlands Antilles 104; Bahrain 74; Taiwan 15.
Motor—do	345	523	--	Singapore 266; China, mainland 257.
Kerosine and jet fuel—do	32	57	--	Singapore 57.
White spirit—do	12	(1)	(1)	China, mainland.[1]
Distillate fuel oil—do	4,372	11,375	--	Kuwait 6,160; Bahrain 4,027; Singapore 762.
Lubricants—do	140	55	40	Netherlands 4; Japan 3; France 2.
Other:				
Liquefied petroleum gas—do	666	646	(1)	Kuwait 257; Singapore 125; Japan 121.
Naphtha—do	2,390	1,487	(1)	Bahrain 943; Kuwait 333; Singapore 142.
Mineral jelly—do	4	4	4	(1)
Mineral wax—do	111	96	4	China, mainland 32; Hong Kong 24; Indonesia 16.
Pitch and pitch coke—do	3	2	--	Singapore 1.
Bitumen and other residues—do	4	2	(1)	United Kingdom 1.
Petroleum coke—do	--	(1)	(1)	
Bituminous mixtures, n.e.s.—do	4	2	1	(1)
Nonlubricating oils, n.e.s.—do	13	15	5	Japan 7; China, mainland 1; United Kingdom 1.

[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—NDC, the investment arm of the Philippines Government, and Reynolds Aluminum Co. of the United States, signed a 50-50 joint venture agreement in February 1980 to build the country's first aluminum smelter on Mindanao Island. The 140,000-ton smelter was expected to be operational in 1985 at a cost of $460 million. A decision was finally made in October 1980 to build the smelter at Claveria near Cagayan de Oro, Misamis Oriental Province, on the Island of Mindanao. Mindanao Island reportedly is not only capable of supplying the proposed smelter with an adequate, reliable, and cheap hydroelectric power but also offers better harbor facilities with a deepwater port capable of serving bulk carriers of up to 250,000 deadweight tons.

In July 1980, the United Nations Development Program granted the Philippine Government a $2 million loan for the survey of the bauxite deposits on Samar Island, central Philippines. The survey would be undertaken by the Philippines Bureau of Mines and Geo-Sciences. The initial exploration indicated the bauxite deposits on the Samar Island were medium grade, containing between 40% to 50% Al_2O_3. The initial estimate of ore reserves was 63 million tons of bauxite with a possible total reserve of about 100 million tons.[7] The development of this bauxite deposit was expected to proceed according to the time schedule of the aluminum smelter project on Mindanao Island, which was expected to use locally mined bauxite mainly from Samar Island.

Chromium.—The Philippines is an important world producer of refractory- and metallurgical-grade chromite. In 1979, its share in the total chromite production of the world was 6%. The overall production of chromite in 1980 declined from that of 1979. Consolidated Mines Inc. contributed 94% of the total refractory chromite ore produced in the first half of 1980, followed by Amer-Asia Mining and Development Corp., 3%; Pulsar Mineral Resources, Inc., and Capital Mineral Resources and Development Co., Inc., 3%. Production of metallurgical chromite ore was by 11 companies. Based on the output of the first half of 1980, the leading six producers were: Velore Mining Corp. accounting for 15.4%; Chrome Ore Minerals Exponents Inc., 14.7%; Palawan Consolidated Mining Co., Inc., 11%; San Grace Mining Corp., 10.3%; Antonio Roa, Jr., 10.3%; and Davao Timber Corp., 10%. The remaining output was by Lino Duhaylungsod, Apollo Talampas, Misamis Exploration Corp., Loyalty Mining and Development Corp., and Santiago Mining Corp. Production of metallurgical chromite concentrate by three companies in the first half of 1980 was as follows: Acoje Mining Co., 71% of total output; and Trident Mining and Industrial Corp., 29%. The other metallurgical chromite concentrate producer, Golden Arrow Mining Co., Inc., stopped operation on January 17, 1980.

Ferrochrome Philippines, Inc., a joint venture of the Herdis Group of Manila and Vöest Alpine AG of Austria, began construction of a P450 million ferrochrome plant at Tagaloan, near Cagayan de Oro, Misamis Oriental, on Mindanao Island in December 1980. The ferrochrome plant would have an annual capacity of 52,000 tons of ferrochrome. Acoje Mining Co., a major producer of metallurgical chromite concentrate as well as another Herdis-Vöest Alpine joint venture company, will supply the metallurgical chromite concentrate to the plant. Vöest Alpine will finance not only the entire project, but will also provide the necessary technology and the marketing of ferrochrome in Japan, the United States, and Australia.

Alamag Corp., a wholly owned subsidiary of Bayer AG of the Federal Republic of Germany, will build a P87.5 million chemical-grade chromium processing plant at Isabela on Samar Island. The chromite deposits were discovered by Island Mining and Industrial Corp., and the chromite deposits in the Isabela area were estimated at 1.93 million tons. Plans call for the chrome processing plant to be operational by 1983 with an initial annual chrome ore processing capacity of 100,000 tons.

In 1980, Golden Arrow Mining Co. expanded its metallurgical chromite milling capacity from 400 to 600 tons per day by installing additional vibrating tables and other equipment at its Silanguin project in Zambales. The company also decided to operate its second chromite project at Bacungan, Palawan, with a planned capacity of 1,000 tons per day, expected to be operational by yearend 1980. Acoje Mining Co. began an expansion and modernization

program at its chromite property at Santa Cruz, Zamabales, to assure a continuous supply of chromite ore and concentrate to the company's overseas consumers, mainly Japan.

According to the Philippines Bureau of Mines, the principal chromite ore reserves of the Philippines were estimated in 1979, as follows:

Owner and/or operator	Mine location	Estimated reserves (tons)	Cr_2O_3 (percent)
Metallurgical chromite:			
Island Mining and Industrial Corp	Divilacan, Isabela	50,700,000	48.00
Acoje Mining Co., Inc	Sta. Crux, Zambales	4,367,470	21.00
Golden Arrow Mining Co., Inc	Puerto Princesa, Bacungan, Palawan.	3,841,290	17.50
Trident Mining and Industrial Corp	Nara, Lapu-Lapu, Palawan.	2,448,782	26.93
Palawan Consolidated Mining Co., Inc	Irahuan, Palawan	1,880,497	35.25
Masinloc Chromite Mining Co., Inc	Masinloc, Agop-op, Candelaria, Zambales.	950,000	32.00
Refractory chromite:			
Consolidated Mines, Inc	Masinloc, Coto, Zambales.	4,811,830	30.45
Armon Mining and Development Corp	Sta. Cruz, Zambales	720,000	20.00

Cobalt.—Cobalt production in the Philippines was by Marinduque Mining and Industrial Corp. (MMIC), the only cobalt producer in the country. Cobalt was extracted and recovered as a byproduct from the company's Nonoc nickel project at Surigao nickel mine and refinery on Nonoc Island. MMIC finalized the plant engineering to increase cobalt recovery at its Nonoc nickel project, which will cost $13 million. The project was expected to be operational by 1981, and a net savings of $8 million per year was anticipated based on prevailing cobalt prices.

Copper.—The Philippines was the world's ninth largest copper producer, accounting for about 4% in 1979. Copper mining remained the major industry of the Philippines mining and quarrying sector as well as the top foreign exchange earners of the Philippines export sector. Based on the value of mineral production, copper accounted for 42.5% of an estimated $1.6 billion worth of minerals produced in the Philippines for 1980.[8]

While total mine output of copper in 1980 increased only moderately from that of 1979, a remarkable 41.4% increase in value of mine output was recorded (from $494.6 million in 1979 to $699.3 million in 1980) owing to higher world copper prices.

Copper production was mainly by 13 primary copper producers, which accounted for 99% of the country's total output, and the remainder was by other producers. The major primary copper producers were: Atlas Consolidated, which operated three open pit mines and one underground mine at Toledo in Midwestern Cebu, accounting for 42% of total mine production; Marcopper at Santa Cruz on Marinduque Island, 11%; Benguet Corp. (formerly Benguet Consolidated) at San Marcelino in Zambales, 8%; Philex at Tuba in Benguet, 7%; CDCP Mining at Basay in Negros, 6%; MMIC at Bagacay on Samar Island and at Sipalay in Negros, 6%; Lepanto at Mankayan in Benguet, 5%; Western Minolco at Atokim in Benguet, 4.7%; Sahena at New Bataan in Davao del Norte, 3%; Consolidated Mines at Mogpog in Marinduque (suspended copper operation in August 1980 to ease mounting cash problems), 2.3%; Baguio Gold at Tublay in Benguet, 2%; and the remaining 2% was by Black Mountain at Tuba in Benquet and Acoje at Mabini in Pangasinan.

During 1980, two copper mines came onstream. Dizon copper-gold project of Benguet Corp., located near San Marcelino in Zambales Province, began operation on January 7, 1980. The total cost of the project was $90 million plus $16 million in financing charges. The complex includes an open pit mine, a 17,000-ton-per-day copper flotation concentrator, and a port. Annual output was expected to be 27,200 tons of copper, 100,000 ounces of gold, and 220,000 ounces of silver. Ore reserves of the area were

estimated at 90 million tons with 0.45% to 0.60% of copper and 0.02 to 0.03 ounce of gold per ton of ore. Azure Mining started up a 500-ton-per-day copper mill in Pilar, Capiz, on October 30, 1980, the first on the Island of Panay. The company plans to expand its mill capacity to 2,000 tons per day of ore by 1982.

Expansion projects expected to be completed in 1981 were: CDCP Mining was to expand its milling capacity from 15,000 to 22,000 tons per day at Basay in Negros Oriental Province by yearend 1981; and MMIC was to complete its plant expansion at Sipalay in Negros Occidental Province from 18,000 to 30,000 tons per day by the first quarter of 1981.

Other expansion programs to be completed after 1981 were: Black Mountain, which planned to expand production capacity from 3,200 to 10,000 tons per day at a cost of $18.5 million; and Sabena Mining, which planned to expand its Davao copper project on Mindanao Island from 10,000 to 17,000 tons per day at a cost of $20.8 million.

Additionally, new copper mines were expected to come onstream in the next 5 years: Bully Bueno project of Hercules and Oils, Inc., located in Cacapian, Marcos, Ilocos Norte, to be operational by the second quarter of 1981; and the Mancayan project in Bulalacao, Mancayan in Benguet, scheduled to open in 1982. The Bully Bueno project has a planned initial capacity of 3,000 tons per day of ore yielding 70 to 75 tons of copper concentrate per day. Amacan project of North Davao Mining Corp. awarded a $76 million turnkey project of a mining plant to a Finnish consortium (Outokumpo Oy, Kone Oy, and Rauma-Repola Oy). The consortium will supply the equipment and technology as well as the installation of the copper mining and ore concentrating complex. The San Antonio copper project of Marcopper, near Tapian, was expected to commence early in 1984. The Hinobaan Copper project in Negros Occidental Province, which is a joint venture project between NDC-Shell Mineral Investment Co. and Billiton International Metals B.V. of Royal Dutch/Shell, was to invest $100 million and own 60% of the project. The remaining 40% was to be owned by a group of companies: Lepanto Consolidated Mines Corp., Delta Mining and Industrial Development Corp., and three property claimants: Colet Mining Co., Sta., Barbara Development Co., and South Mining and Exploration Co. Ore reserves of the Hinobaan deposit were estimated at 90 million tons with an average of 0.5% copper.

Based on forecasts made by the Philippines Bureau of Mines and Geo-Sciences, the new copper mines would have an average milling capacity of 10,000 tons per day each. This would increase the Philippines copper concentrate production to about 200,000 tons per year by 1985.

According to the latest company annual reports, estimated reserves of the principal deposits in the Philippines, by owner and/or operator and grade, as of December 1979, were:

Owner and/or operator	Estimated reserves (tons)	Copper (percent)
Atlas Consolidated Mining and Development Corp	900,441,000	0.45
Marcopper Mining Corp	101,200,000	.43
Marinduque Mining & Industrial Corp	651,000,000	.49
CDCP Mining Corp	111,789,000	.45
Philex Mining Corp	154,153,000	.38
Consolidated Mines, Inc	101,767,000	.50
Benguet Corp. (formerly Benguet Consolidated, Inc.)	84,341,000	.45
Lepanto Consolidated Mining Co	5,567,400	.25

The Philippines Associated Smelting and Refining Corp. (PASAR), the owner of the Philippines first copper smelter project, has chosen a Japanese consortium as its major foreign partner of the copper smelter project and the exclusive distributor of 76% or 105,000 tons per year of the smelter's 138,000-ton-per-year output. The Japanese consortium (50% owned by Marubeni Corp., 30% by Sumitomo Corp., and 20% by C. Iton and Co.), will invest $32 million in the project's $100 million equity or a 32% equity position in PASAR. International Finance Corp., a World Bank subsidiary, was offered 5%. The remaining 63% equity will be held by the Philippines Government through NDC (34.3%), and the remainder (28.7%) to be shared by nine local copper producers. The equity contribution of the participating nine mining companies were Atlas, $10 million; Lepanto, $4.65 million; Marcopper, $4.13 million; MMIC, $2.52 million; Sabena, $2.17 million; Philex, $1.81 million; CPCD Mining, $1.81 million; Western Minolco, $1.02 million; and Black Moun-

tain, $0.29 million.[9]

Construction of the $250 million smelter at Isabel in southern Leyete started in August 1980. The support structure was 50% completed as of early October (expected completion to be by the end of 1980). Roadways were 15% completed and plant-site grading was 30% completed. Marubeni Corp. won the turnkey contract for the smelter construction and was expected to ship materials and equipment from Japan to the smelter site in early November. The entire project was scheduled for completion in 1983. During the first year of operation, the smelter was expected to process 480,000 tons of concentrate, produce 138,000 tons of copper, 195,000 ounces of gold, 850,000 ounces of silver, 161 pounds of selenium, and about 480,000 tons of sulfuric acid.

Gold.—The Philippines continued to be one of the top 10 world gold producers. Its share in the world total gold production was about 2% in 1979 and the Philippines was the world's sixth largest producing country. Gold mining remained the second most important industry of the Philippines mining sector. It accounted for about 14% of the value of the Philippines mineral production in 1980. Despite three newly opened gold mines in 1980, gold production increased only moderately over that of 1979. However, the value of gold output rose 42% from $158.2 million in 1979 to $224.6 million in 1980, owing to higher prices of gold, which averaged about $612 per ounce in 1980 compared to $303 per ounce in 1979.

About 30% of total gold produced in 1980 was by 7 primary producers, and 70% was by 12 copper producers, which operated copper and gold mines. The top seven gold producers were: Benguet Corp.—formerly Benguet Consolidated—(both primary and byproduct output), accounting for 28.8% of total gold production; Atlas (primary and byproduct), 23.2%; Philex (byproduct), 18.0%; Lepanto (byproduct), 9.5%; Marcopper (byproduct), 4.0%; Western Minolco (byproduct), 3.9%; and Apex (primary), 3.6%. The remaining 9% of total gold production was by Benguet Exploration, Itogon, Vulcan, and Manila (all primary producers); and Baguio Gold, MMIC, Sabena, CDCP Mining, Black Mountain, and Consolidated Mines (all byproduct producers).

Three new gold mining projects that came onstream during 1980 were: (1) Dizon copper-gold project of Benguet Corp. (see copper section). (2) Masbate gold project of Atlas in Aroroy on Masbate Island (a rehabilitation of an old project at a cost of US$23 million). The site is an open pit mine with a capacity of 3,500 tons per day of ore, capable of producing 90,000 ounces of gold and 100,000 ounces of silver annually. The estimated ore reserves could last 8 years of operation (but further exploration was expected to extend the economic life of the mine). (3) Surigao mining project of Manila Mining Corp. at Placer in Surigao del Norte commenced operation in January 1980. (This is a $6 million gold mill with a capacity of 200 tons of ore per day, capable of producing 1,800 ounces of gold per month. Lepanto acted as general manager of the project for Manila Mining.)

Four other important new gold projects that were expected to come onstream in 1981 or later as a result of higher gold prices were: (1) Surigao Consolidated Mining Co. The old La Suerte gold mining operations at Jose Panganiban, Camarines Norte in Southern Luzon, was to be reactivated at a cost of $6.6 million. The gold mill was expected to be operational in January 1981 with a capacity of 1,000 tons per day. The main source of ore is the Luna Pelang vein with an estimated reserve of 302,000 tons, averaging 0.286 ounce of gold per ton of ore. Surigao Consolidated Mining Co. will also start an open pit mine at Barrio Siana, Mainit, Surigao del Norte, on Mindano Island, during the fourth quarter of 1981. The mill capacity was rated at 1,000 tons per day with an estimated reserve of 3.7 to 4.5 million tons, ranging from 0.5 to 0.17 ounce of gold per ton of ore. The project costs were $7.2 million with an estimated economic life of 10 to 14 years. (2) Philippines Eagle Mines, Inc. (formerly Metal Exploration Asia, Inc.), which took over the property from Marsman and Co. at Panacale in Camarines Norte, will start its Longos gold production operation during the first quarter of 1981. The initial milling capacity would be 500 tons per day. The ore reserves at Panacale were estimated at 1.5 million tons, averaging 0.5 ounce of gold per ton of ore. The project costs were $29 million including a $20 million mill plant. (3) Gold Arrow Mining Co., an important metallurgical-grade chrome ore and concentrate producer, will start operation of its Labo gold project in Camarines Norte in January 1981 with a capacity of 1,000 tons per

day. The proven ore reserve of the area was expected to last 5 years. The company was reportedly planning to operate a $26 million gold project in Run-runo, Quezon, Nueva Vizcaya, in 1981. The plan calls for a gold mill with a capacity of 2,500 tons per day. The proven reserves of the area were estimated at 9 million tons, with an overall grade of 0.054 ounce of gold per ton of ore. (4) Batony Buhay Gold Mines Inc., a new gold producer, was expected to start its 9,000-ton-per-day Batong Buhay copper-gold mill in Kalinga-Apayao of northern Luzon. The project, currently managed by Philex Mining Corp., reportedly has spent about $200 million for equipment and for mine development costs, and an additional $40 million would be needed to bring the mine into production. Ore reserves of the area were estimated at 54.3 million tons, averaging 0.599% copper and 0.12 to 0.373 gram of gold per ton of ore.

Iron and Steel.—In 1980, there was no production or export of iron ore. San Pio Guinto Mining Corp., the only producer of lump ore in 1979, reportedly has stopped operation.[10]

Sta. Ines Mining and Steel Corp., a joint venture between the Seguera family and Nihon Metallgesellschaft, an affiliate of Lurgi Chemi und Huttentechnik GmbH of the Federal Republic of Germany, has secured all the financing needed to start its P300 million iron ore mining and milling project in Antipolo, Rizal. The project would be financed 70% by stockholders of the company, 20% by Nihon Metallgesellschaft, and the remaining 10% by other foreign investors. The project would put up an iron ore processing plant in Antipolo, Rizal, to process the iron ore produced from its mine in Mount Masarat near the Quezon and Camarines Norte boundary by 1984. The proposed plant would have an annual capacity of 1.5 million tons of iron ore concentrate. Lurgi will conduct the project's engineering work and supply the mining and milling equipment on a turnkey basis. Nihon Metallgesellschaft will handle the marketing of Sta. Ines iron ore concentrate in the world market during the first 3 to 5 years of operation.

The viability of an integrated steel mill development project at the Phividec Industrial Estate in Villanueva of Misamis Oriental Province, originally scheduled to be completed by 1985, was still under review in 1980. The Government has commissioned Vöest Alpine AG of Austria to conduct a study to find out the suitability of domestic raw materials for several small plants, each with an annual capacity of 200,000 tons per year, instead of a giant steel mill at 1.5 to 2 million tons per year as proposed by a Japanese study. Two likely domestic raw material sources cited by the Philippines Board of Investments were the tailings of nickel mining and refining operations of MMIC in Nonoc, Surigao del Norte; and iron cinders, a byproduct of the forthcoming phosphatic fertilizer operation of Philippine Phosphate Fertilizer Corp. in Isabel. United States Steel Corp. of the United States, Nippon Steel of Japan, and Thyssen Steel of the Federal Republic of Germany have expressed interest in supplying the equipment and/or minority equity participation.

Nickel.—The Philippines nickel mine output accounted for 5% of the world's total mine production. Value of nickel output was 11% of the Philippines total mineral production in 1980, and was the third most important industry in the country's hard mineral sector.

MMIC, a major nickel ore producer and the only refined nickel producer of the Philippines, produced about 75% of the country's total nickel output in 1980. MMIC operated a Surigao nickel refinery at Nonoc, Surigao del Norte, with an annual capacity of 34,000 tons of refined nickel. After a 23-day plant turnaround in July 1979, the capacity utilization reached 81.4% in October 1979 for the first time, and reached another new high at 84.5% in May 1980. The average capacity utilization in 1980 was 73.7%, about 17% higher than that of 1979. MMIC nickel production is expected to continue to increase in 1981 if the world market prices of nickel remain at the current levels of about $3 per pound. In an effort to reduce the energy costs of its Nonoc nickel refinery, MMIC obtained a $70 million loan from the Banco Exterior de Espana and a $25 million loan from the Development Bank of the Philippines to finance converting the power source from oil to coal. The coal-fired plant, that will replace an oil-driven power kiln at its Nonoc nickel refinery, would result in a savings of about $33 million per year for the company.

The other important nickel ore producer in the Philippines was Rio Tuba, which operated a nickel mine at Bataraza on Palawan Island.

MMIC shipments in 1979 were as follows: 45.7% went to Europe, 37.7% to the United

States, 10.9% to Japan, 2.7% to other Asian countries, 2.1% to Canada, and the remaining 0.9% to domestic consumers. All of Rio Tuba's shipments went to Japan.

Based on the previous estimate by the Bureau of Mines and Geo-Sciences in 1976, the country has 3,822 million tons of nickel reserves averaging 0.96% nickel. However, the most recent figures released by the Mineral Economics and Information Division of the Bureau of Mines and Geo-Sciences indicated that as of December 31, 1979, the total nickel ore reserves of the country were estimated at 1,479,462,378 tons, with ore grades ranging from 0.23% to 2.4% nickel.[11]

Uranium.—The Australian Government and the Philippines have agreed in principle to a 5-year joint project to find and define prospective uranium mining areas in the Philippines. The project was expected to spend a total of P34 million for uranium exploration and training. The Australian Government will contribute $2.5 million for technical expertise and technology to conduct airborne radiometric surveys, which would pinpoint targets for groundwork. The Australian team will also train Philippine scientists in uranium exploration. The initial exploration will start in the first quarter of 1981 and the target areas are to be in the Ilocos region, Mindoro, Polillo Island, Cataduanes, Masbate, Isabela, and Nueva Vizcaya.

Other Metals.—Production of unwashed manganese ore was by Black Rock Mining Corp. at Dimapique, Isabela, and Associated Mining and Industrial Corp. at Cabadbaran, Agusan del Norte. Lead was produced by Zambales Base Metals, Inc., from its lead-zinc-copper operation at Ayala district, Zamboanga City in Zamboanga del Sur. Zinc production by Zambales Base Metals, Inc., accounted for 54% of total zinc output in 1980, and the remainder was by Benguet Exploration, Inc., from its gold-silver-zinc-copper operation at Tuba, Benguet. Production of molybdenum was mainly by MMIC from its Sipalay copper-gold operation as a byproduct at Cartagena, Negros Occidental. Other producers of molybdenum were Black Mountain, Atlas, and CDPC Mining.

NONMETALS

Cement.—Under the country's cement industry rationalization program, five 1-million-ton-per-year-capacity cement plants were to be constructed over the 1980-85 period. Under the program, new cement plants must be coal fired; plant sites must be located at a place where the raw material reserves are adequate, and good harbor facilities must be available for receiving the coal and distributing the cement; and 70% of plant output must be exported. In June 1980, the Philippine Cement Industry Authority (PCIA), selected Negros Cement Corp. (NCC) to build the first of the five cement plants at Basay, Negros Oriental, adjacent to the shipping facility of CDCP Mining, the largest construction company in the country as well as the major copper and gold producer. NCC was formed by the CDCP Group in 1980. NCC reportedly has a marketing contract with Phillips Bros. of the United States, which has been committed to a 30% equity participation in the cement plant. Lone Star Cement of the United States reportedly was also interested in investing in the project. The project cost was estimated at more than $100 million, and was expected to be operational in 1984.[12]

The cement industry rationalization program also calls for the cement industry to rehabilitate equipment and to modernize existing plants. The Government will assist companies that convert their fuel systems from bunker to coal-fired kilns. It was reported that the Northern Cement Corp., one of the leading cement producers of the Philippines, would be the first cement plant in Luzon to convert from bunker oil to wholly coal-fired kilns. The company would also install new equipment and expand its capacity to 1 million tons per year by 1981.

Krupp Polysius AG of the Federal Republic of Germany was awarded a $33.3 million contract in November 1980 to convert nine oil-fired cement plants to coal in the Philippines. According to the contract, Krupp would supply and install the coal-fired cement kiln and other equipment at the plants by 1982.

In 1980, the Philippines had 17 cement plants, which operated at about 70% of total industry capacity of 7.4 million tons. Low capacity utilization was due to outmoded equipment, inefficient plant size (no plants have an annual capacity of 500,000 tons), inadequate working capital, and lack of the required electrical supply.

Cement manufacturing is the most important industry in the Philippines nonmetallic mineral production sector. In 1980, the Philippines production of cement was valued at $230 million, which was about 27% higher than that of 1979, and accounted for 63% of nonmetallic and 14% of the Philip-

pines total mineral production.

Dolomite.—Philippine Mining Service Corp., a joint venture company between Kawasaki Steel Corp. and Kawatetsu Mining Co. of Japan, and Dolomite Mining Corp. of the Philippines, was formed in July 1980. Kawasaki reportedly has a 40% interest in Philippine Mining Service Corp., which would mine the dolomite deposits of Dolomite Mining Corp. under a service contract at Alcoy in Cebu, about 60 miles from Cebu City. The mining area involves 52 hectares with a proven minable ore reserve of 15 million tons. The total cost of the project was estimated at $8 million. Construction of the facilities started in July 1980, and they were expected to be operational by October 1981. The company plans to produce 360,000 tons of dolomite per year during the first 2 years of operation and gradually increase to 500,000 tons per year in later years. Kawasaki Steel Corp. was expected to purchase most or all of the dolomite produced from the dolomite mine in Cebu Island.[13]

Fertilizer.—As one of the Philippines 11 industrial projects announced in 1976, plans for a phosphatic fertilizer plant finally started in 1980. The Philippines Phosphatic Fertilizer Corp. (Philphos), the owner and operator of the country's $370 million fertilizer project, has decided to build the plant at Isabel on Leyte Island in central Philippines. In August 1980, the company sent invitation-to-bid papers and other documents to four consortiums. The successful bidder would build the complex on a turnkey, fixed-price basis. Construction was to start in the spring of 1981, and be completed by February 1983. The whole complex would have four plants: A sulfuric acid plant, a phosphoric acid plant, a granulation plant, and an ammonium sulfate plant. The planned annual capacity is 350,000 tons of phosphatic fertilizer. After negotiations with several candidates, the Government of the Philippines finally accepted the investment offer made by Nauro Phosphatic Corp. (NPC) of the Central Pacific Republic of Nauro in a 40% equity participation or with $40 million in a form of raw material (phosphatic rock) to be supplied by NPC for the fertilizers plant. The other raw material—sulfuric acid, would come from the neighboring copper smelter, which was scheduled to be operational in 1983. However, some pyrites would have to be imported.[14] The Philippines Bureau of Mines and Geo-Sciences also identified several phosphate rock reserves in seven Provinces for the raw material sources of the fertilizer plant. Phosphate rock reserves in Leyte were estimated at 1.23 million tons; Negros Occidental, 219,344 tons; and Davao del Norte in Cebu, 185,728 tons. The total reserves of the seven Provinces were estimated at 2.08 million tons of phosphate rock.

Silicon.—Maria Cristina Chemical Industries (MCCI) planned the construction of a P80 million silicon plant at Ayungon, Negros Oriental. The company has already invested P10 million in the silicon plant at the mine site set up 2 years ago in a 400-hectare lot in Barangay Maaslm, Negros Oriental. The silica produced from the mine was shipped to MCCI's plant in Iligan City to make ferrosilicon. The ferrosilicon produced by the company was exported to Romania, Japan, Australia, and Southeast Asian countries. The silica ore deposits at Ayungon was estimated at 500 million tons.[15]

MINERAL FUELS

Coal.—For the first time, the production of coal increased 20% from that of 1979, and passed the 300,000-ton level in 1980. In 1979, coal production was produced mainly from three coal mining areas in Cebu Island by about 50 small privately owned coal mine operations, accounting for 85% of total production. The remaining 15% of the production was from Gigaquit in northeastern Mindanao and from Burdeos on Polillo Island. In 1980, a new open pit coal mine, operated by Vulcan Industrial and Mining Corp. on Semirara Island off the southern coast of Mindoro Island, started production at 300 tons of coal per day. The projected production of coal was to reach 150,000 tons in 1981 and 250,000 tons in 1982, with an additional investment of P14 million for acquiring necessary equipment. The characteristics of Semirara coal has been specified as low ash and sulphur contents, fixed carbon content of 31% to 52%, and a heating value ranging from 9,000 to 10,000 Btu's per pound.

Presently, almost all of the coal produced in the Philippines is consumed by various domestic cement plants and some utility companies. According to the Philippines Ministry of Energy, coal contributed only 1% of the country's total energy requirements in 1979. In line with a long-term strategy of accelerating the development of indigenous energy resources, coal's share of

the Philippines total energy requirements would be increased to 13.5% in 1985 by increasing annual coal production to 2.3 million tons, and importing the remaining 3.1 million tons possibly from mainland China, the United States, and Australia.

During the past decade, the Philippines has been actively engaged in coal exploration and development. As of early 1980, there were 13 coal mines under various stages of active exploration. Six were along the northeastern coast of Mindanao, one on Cebu Island, two on Catanduanaes Island, two on Mindoro Island, and two in Luzon. According to the Philippines Bureau of Energy Development, the Philippines has a proven coal reserve of 186 million tons as of 1980. The most promising coal areas reportedly were in Cebu, Zamboanga del Sur, Semirara Islands, Bataan Island, and Polillo Islands.

The Government of the Philippines planned to set up six coal depots in the coming years to supply the fuel needs of mines and cement plants, which were to shift from bunker-oil to coal-power generation. The depots will also serve as blending stations. The feasibility studies on the depots were completed, but the financing has yet to be lined up. According to the Ministry of Energy, the depots would be located at the North Harbor in Manila; Poro Point in La Union; Naga cement plant in Cebu; Pacific cement plant in Surigao del Norte; MMIC plant on Nonoc Island; and Iligan City, where Iligan Cement, Floro Cement, and Mindanao Cement have plants.

The Government of the Philippines also created the National Coal Authority in September 1979 to handle the marketing, importation, blending, storage, and distribution of coal in the country.

Petroleum and Natural Gas.—In 1980, the only oil-producing field was Nido, which went into full production in February 1979, and reached a peak of 40,000 barrels per day in September 1979 with five productive wells. Average daily output of Nido Oilfield dropped to about 14,000 barrels per day in January of 1980. By February, Nido A-1, the biggest well, was shut down after water seeped into the oil flow. On March 20, Nido A-2, B-1, B-2, and B-3A were also shut down for 5 days to allow repairs on the single-buoy mooring system. All four wells, except A-1, which has shut down permanently, resumed production later, but the average daily output declined from 11,000 barrels per day in July to 9,000 barrels per day in October, and declined further to 3,500 barrels per day at the end of 1980.

The operator of Nido Oilfield, Cities Service has revised the original estimate of the Nido Oilfield's oil reserves of 45 million barrels to between 11.5 and 17.1 million barrels. In late 1980, Oildeco, a Norwegian company was hired by Cities Service to review its initial studies and data. At the same time, the Philippines Ministry of Energy, in cooperation with the Indonesian Pertamina, also conducted its own reassessment. According to Cities Service, by the end of 1980 a total of 12.2 million barrels has been pumped out since the Nido Oilfield went into production in February of 1979.

During the 1977-80 period, the Philippines discovered four new oilfields near the existing Nido Oilfield, offshore northwest of Palawan Island: Cadlao Oilfields, discovered by Amoco about 20 miles north of Nido Oilfields in 1977, (Cadlao-1 and Cadlao-3 wells were scheduled to produce at an initial rate of 9,000 barrels per day in June 1981); Matinloc Oilfield, discovered during the 1979-80 period by Cities Service about 12.5 miles northeast of Cadloa Oilfield, was to start production in late 1981 at an initial rate of about 11,000 barrels per day. Two other oil discoveries also made by Cities Service are the Pandan Oilfield and Libro Oilfield. The former is located about 33 miles northeast of the Nido Oilfield and the latter about 4.3 miles east of Pandan Oilfield. Based on data released by the operators, the quality of crude oil from these newly discovered oilfields is of low-sulfur crude oil with an API gravity of 43° to 44°.

Domestic crude oil production accounted for 10% of the country's annual consumption of about 85 million barrels in 1979, and for only about 2% in 1980. Combined output of Nido and Cadlao was estimated to produce about 5% of the Philippines oil consumption of 89 million barrels in 1981.

In mid-1980, the State-owned PNOC Exploration Corp. (PNOC-EC) discovered a natural gas well, San Antonio-1, located in Barrio San Antonio in Echague of Isabela Province, onshore of the Cagayan Valley Basin. This is the only productive gas well found so far out of five wells drilled. Reportedly, the initially estimated flow rate of 6 million cubic feet per day was revised to 12 million cubic feet per day.

The Philippines reportedly will build a $141 million 100,000-barrel-capacity refinery in Limay, Bataan Island, by 1983. A new $10-million crude oil import terminal of the

Bataan Refining Corp. in Limay was completed in June 1980. A $60 million gas terminal next to its refinery in Tabangao reportedly will built by NDC-Shell Mineral Investment Co. in 1983.

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[1]Economist, Branch of Foreign Data.

[2]Where necessary, values have been converted from the Philippines Peso to U.S. dollars at the rate of P7.46=US$1.00.

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[3]Business Day (Manila). Sept. 9, 1980, p. 1. Philippines Daily Express (Manila), Sept. 22, 1980, p. 1.

[4]Business Day (Manila). Mar. 17, 1980, p. 1.

[5]U.S. Embassy, Manila, Philippines. Department of State Airgram A-110, Sept. 16, 1980.

[6]Business Day (Manila). Sept. 22, 1980, p. 1. The Asian Wall Street J. Sept. 19, 1980, p. 1.

[7]Chamber of Mines of the Philippines. Newsletter, v. 5, No. 2, February 1980, p. 1.

U.S. Embassy, Manila, Philippines. Department of State Airgram A-71, June 16, 1980.

[8]U.S. Embassy, Manila, Philippines. Department of State Airgram A-02, Jan. 2, 1981.

U.S. Embassy, Manila, Philippines. Department of State Telegram 25290, Dec. 19, 1980.

[9]The American Chamber of Commerce of the Philippines, Inc. Business J., v. 55, No. 10, October 1980, p. 96.

[10]U.S. Embassy, Manila, Philippines. Department of State Airgram A-121, Oct. 3, 1980.

[11]Business Day (Manila). Nov. 27, 1980, p. 22.

[12] Philippines Daily Express (Manila). June 19, 1980, p. 10. U.S. Embassy, Manila, Philippines. Department of State Telegram 11869, June 19, 1980.

[13]The Asian Wall Street Journal. July 23, 1980, p. 13. Times J. (Manila). July 6, 1980, p. 1.

[14]The Asian Wall Street Journal. Aug. 15, 1980, p. 3. Philippines Daily Express (Manila). Aug. 28, 1980, p. 9.

[15]Philippines Daily Express (Manila). Dec. 15, 1980, p. 17.

The Mineral Industry of Poland

By Tatiana Karpinsky[1]

In 1980, the production plan in Poland was not fulfilled in many sectors of industry. The economic situation of the country was extremely difficult, and Poland was in deep political and economic crises. A huge wave of strikes along the Baltic coast and Silesia Coalfields in August and early September 1980 was followed by a rash of smaller stoppages throughout the country. Strikes hit many industries, labor productivity dropped, and discipline deteriorated. The results were particularly visible in the coal, steel, copper, sulfur, fertilizer, and cement industries, where production was short of the planned targets for 1980.[2]

On September 14, Poland's Council of State issued a decree on legal procedures for the registration of new trade unions to be formed outside the jurisdiction of the existing Central Council of Trade Unions. The decree came exactly 2 weeks after the strike settlement in Gdansk had provided the workers with the right to form their own independent and self-governing organizations. On November 10, 1980, Poland's Supreme Court legally registered the Solidarity labor union, and this move defused political tension in the country.

According to an agreement between the Government commission and the Interfactory Strike Committee concluded on September 3, 1980, at the July Manifesto coal mine, the new system of free Saturdays is to be introduced in coal mines, as of January 1, 1981.

According to the Ministry of Mining, output of coal in the first three quarters of 1980 was 4 million tons less than planned. At yearend, the country was short 13 million tons of coal against the planned 206 million tons. The shortage in coal production affected coal exports. Deliveries of coal to the ports for export were greatly reduced, and stocks at Szczecin and Swinoujscie Ports were already exhausted at the end of September.

In 1980, the production of steel fell short of the plan by about 2.7 million tons; the output of rolled products by 716,000 tons; production of copper by about 33,000 tons; and production of electrical energy by 3 billion kilowatt-hours.

According to Polish sources, national income in 1980 decreased 4% compared with the 1979 level and decreased 6% compared with the 1978 level; the total output of industry fell by approximately 4%. Capital investments decreased from 23.2% of the national income in 1979 to 19.7% in 1980. While there was an overall reduction in the value of output, wages increased and amounted in zlotys (Z) to Z359 billion, an increase of 14% over that of 1979.[3]

The total number of industrial workers and employees in State enterprises in Poland was 4,754,000 in 1979 and 4,758,000 in the first half of 1980. The number of workers and employees in State mineral and energy enterprises by branch is given in the following tabulation for 1979:[4]

Branch	Total workers and employees (thousands)	Workers (thousands)	Percent of total employment in industry
Coal	402	323	8.5
Other fuel	51	37	1.1
Power	85	53	1.8
Ferrous metals	187	143	3.9
Nonferrous metals	74	53	1.5
Building materials	186	139	3.9

In 1980, Poland was involved in the construction of nine raw material projects within the CMEA countries.[5] In exchange, in addition to the quantities provided for by a longstanding agreement, Poland received from the U.S.S.R. about 1 million tons of crude oil, 2.8 billion cubic meters of natural gas, 2.5 million tons of iron ore, 61.8 thousand tons of ferroalloys, and 25,000 tons of asbestos.[6]

With a new large coal mining and power complex at Belchatow and several other power projects underway, Poland was still facing an energy shortage. Therefore, Poles have taken an active part in building three nuclear power stations in the Soviet Union to receive in return 1,200 million kilowatt-hours of electric energy in 1984 and 6,000 million kilowatt-hours annually in the years 1988-2003. In Khmielno, Kursk, and Smolensk, 1,600 Polish workers were engaged in construction worth 200 million rubles. The number of Poles working there is to rise to 5,000. In addition, Poland is to supply equipment for these nuclear power projects worth about 200 million rubles.

The targets of the seventh 5-year plan (1981-85) were initially outlined at the Eighth Congress of the Polish United Workers Party which met in Warsaw in February 1980.[7] The program outlined at the Congress foresees further economic growth and improvement of working and living conditions. The seventh 5-year plan envisages an increase of 14% to 18% in the national income and 20% to 24% in gross industrial output.

In the 1981-85 period, Poland will concentrate its investment in the energy, transport, and agricultural sectors. Capital investment is planned to fall from about 26% of national income in 1978 to under 20% in 1981-85.

Poland is planning to accelerate modernization of many branches of industry, increase its exports, and increase housing construction. Priority is to be given to food production.

According to the plan outlined at the Eighth Party Congress, the mineral commodity production for 1985, in million tons, is as follows:

Copper	0.5
Zinc	.2
Lead	.1
Crude steel	24.0
Rolled steel products	17.0
Fertilizer materials:	
Nitrogen	1.7
Phosphorus	1.2
Bituminous coal	235.0
Lignite	80.0-90.0

In the 1980's, the primary area of cooperation within the CMEA will be participation in the implementation of long-term directional programs of cooperation, which were prepared following the resolutions adopted at the 30th CMEA Session in 1976. The programs concern cooperation in five branches of material production until 1990, including fuel, energy, and raw materials.

On December 3, 1980, the Central Committee put the Government under obligation to work out, within the framework of the 5-year plan, a 3-year plan for restoring economic equilibrium and economic stabilization to the country. This plan is to determine the direction for concentrating the means and structural changes indispensable for improving the financial and market situation; expanding agriculture; meeting the material, raw material, and energy needs; developing the economy's export capacity; and improving the State's balance of payments.

The plan for 1981 is to be the first stage of the 3-year program of economic stabilization and for solving existing difficulties. The Polish economic plan for 1981 is modest, but was not fully elaborated in 1980. The Government planning commission expects the level of industrial output in 1981 to be close to that of 1980. Some sectors should have even lower production. Investment outlays will be lower by at least Z100 billion, that is, by about 20% compared with 1980 levels. The volume of mining production compared with that of 1980 will probably be lower. This concerns hard coal, copper, zinc, lead, and sulfur.[8]

In connection with the introduction of an economic reform starting January 1, 1981, enterprises are determining their annual plans on their own. The tasks determined

by industrial unions, ministries, and the State Planning Commission of the Council of Ministers concern only some issues. Therefore, economic results of 1981 will depend to a considerable extent upon independent initiatives of the basic economic organization.

Poland's debts to developed economy countries amounted to about $23 billion in 1980. Poland counted on a surplus of $600 million in trade in 1980, but instead had a foreign trade deficit of about $700 million.

At the end of 1980, Poland's population totaled 35.7 million, an increase of 322,000 over the 1979 total.

PRODUCTION

Poland has large reserves of coal, lignite, sulfur, copper ore, salt, and lead and zinc ores. However, the country must import crude oil, gas, iron ore, magnesite, kaolin, phosphate, chromium, molybdenum, manganese, and a few other materials.

In 1980, only 40% of the projects envisioned for completion were actually completed. By the end of 1980, capital tied up in incompleted investments had grown to Z800 billion, compared with Z665 billion at the end of 1979. Industry was badly affected by shortages of raw and semifinished materials, fuel, and energy, as well as by work stoppages and strikes. According to official results, output of the majority of "basic articles" fell in 1980, compared with that of 1979. Decline was even greater compared with the 1980 plan.

In 1980, production dropped for coal, rolled steel products, primary aluminum, fertilizers, and cement. Increases were reported in some products, including pig iron and electrolytic copper. Economic results for the first 6 months of 1980 were respectable, with both national income and industrial production; however, the industrial picture deteriorated during the second half of 1980. Economic results of the first and second half of 1980, compared with the same periods in 1979 follow, in percent:

1980	First half	Second half
Hard coal	106.6	89.5
Crude steel	106.2	96.9
Rolled products	105.0	95.5
Cement	111.5	82.3

Table 1.—Poland: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum metal, primary	103,000	104,000	100,000	96,600	90,000
Cadmium metal, primary	[e]750	754	761	773	760
Copper:					
Mine output, metal content, recoverable	267,000	289,300	321,000	325,000	[3]346,125
Metal:					
Smelter, including secondary	281,200	311,000	337,000	341,000	[3]363,500
Refined, including secondary	270,100	306,600	332,200	335,800	[3]357,300
Iron and steel:					
Iron ore and concentrate, gross weight thousand tons	674	659	529	249	200
Pig iron do	7,912	[r]9,517	11,109	10,966	10,000
Ferroalloys:					
Blast furnace do	124	134	126	138	126
Electric furnace do	164	[r]175	169	176	170
Steel:					
Crude do	15,639	17,841	19,251	19,218	[3]19,484
Semimanufactures:					
Rolled, excluding pipe do	11,501	11,950	13,566	13,577	[3]13,551
Pipe do	1,135	1,183	1,164	1,161	[3]1,132
Lead:					
Mine output, metal content, recoverable	[e]60,000	63,000	63,900	61,900	58,800
Metal, refined, including secondary	80,600	85,400	86,700	84,200	80,000

See footnotes at end of table.

Table 1.—Poland: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Nickel:[e]					
Mine output, metal content, recoverable	[r]2,500	[r]2,400	[r]2,400	[r]2,100	2,100
Metal, smelter	[r]2,500	[r]2,400	[r]2,400	[r]2,100	2,100
Silver, mine output, metal content, recoverable[e] thousand troy ounces	17,800	10,708	21,900	[r]22,600	23,100
Zinc:					
Mine output, metal content	[e]180,000	188,000	194,000	182,700	180,000
Metal, refined, including secondary	237,000	228,000	222,000	209,000	205,000
NONMETALS					
Barite	80,342	88,700	90,300	96,000	92,000
Cement, hydraulic thousand tons	19,800	21,300	21,700	19,176	[3]18,443
Clays and clay products:					
Crude:					
Bentonite[e] do.	50	50	50	50	50
Fire clay do.	1,261	1,352	1,292	1,251	1,200
Kaolin do.	95	91	66	49	50
Products do.	794	785	768	687	600
Feldspar[e] do.	30	40	40	40	40
Gypsum and anhydrite, crude[e 4] do.	1,250	1,340	1,350	1,360	1,300
Lime, hydrated and quicklime do.	8,117	8,638	9,135	7,652	7,500
Magnesite, crude	26,300	25,400	[e]24,400	[r e]20,000	18,000
Nitrogen: N content of ammonia thousand tons	1,726	1,665	1,611	1,525	1,300
Salt:					
Rock do.	1,652	1,562	1,435	1,458	1,100
Other do.	2,166	2,795	2,958	2,971	2,300
Sodium and potassium compounds, n.e.s.:					
Sodium carbonate (soda ash) do.	726	671	663	684	680
Caustic soda (96% NaOH) do.	388	450	489	454	430
Stone:					
Dolomite do.	2,393	2,685	3,118	3,296	3,200
Limestone do.	7,300	NA	NA	NA	NA
Quartzite do.	265	261	NA	NA	NA
Other do.	16,319	17,254	17,476	17,610	16,000
Sulfur:					
Native:					
Frasch[e] do.	4,341	4,321	4,546	[r]4,310	4,000
Other than Frasch[e] do.	550	450	505	[r]520	500
Total do.	4,891	4,771	5,051	4,830	4,500
Byproduct:[e]					
From metallurgy do.	239	314	315	[r]310	300
From petroleum do.	25	35	35	35	30
Total do.	264	349	350	[r]345	330
From gypsum[e] do.	55	30	20	20	20
Total sulfur do.	5,210	5,150	5,421	5,195	4,850
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous do.	179,302	186,200	192,622	201,004	[3]193,121
Lignite and brown do.	39,309	40,800	41,005	38,083	[3]36,866
Total do.	218,611	227,000	233,627	239,087	[3]229,987
Coke:					
Coke oven do.	17,868	19,055	20,356	20,037	[3]19,850
Gashouse do.	932	[r]945	950	950	940
Total do.	18,800	20,000	21,306	20,987	20,790
Fuel briquets, all grades do.	1,673	1,697	1,752	1,800	1,700
Gas:					
Manufactured:					
Town gas million cubic feet	[r]18,967	[r]17,377	16,282	14,233	14,000
Coke oven gas do.	[r]247,628	[r]258,507	265,359	261,015	250,000
Natural, marketed do.	[r]236,609	[r]257,695	282,242	259,072	220,000
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	178	[e]85	[e]85	[e]85	80
Propane and butane do.	58	[e]58	[e]58	[e]58	53
Peat:					
Fuel	2,000	1,100	600	NA	NA
Agricultural[e]	35,000	35,000	35,000	35,000	35,000

See footnotes at end of table.

Table 1.—Poland: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum:					
Crude:					
As reported ____ thousand tons__	455	364	363	331	330
Converted _ thousand 42-gallon barrels__	3,376	2,701	2,693	2,456	2,448
Refinery products:					
Gasoline ____ do____	22,448	28,518	29,325	28,720	27,300
Kerosine (presumably including jet fuel) do____	1,132	1,194	1,240	1,105	1,050
Distillate fuel oil ____ do____	36,368	38,031	39,240	38,663	36,750
Residual fuel oil ____ do____	33,287	29,131	29,970	29,826	28,350
Lubricating oil ____ do____	3,052	} 3,276	3,430	3,314	3,150
Grease ____ do____	[e]100				
Paraffin ____ do____	173	189	197	__	__
Liquefied petroleum gas____ do____	2,123	2,285	2,320	2,209	2,100
Bitumen ____ do____	6,933	7,017	7,090	6,628	6,300
Total[5] ____ do____	105,616	109,641	112,812	110,465	105,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 10, 1981.

[2]In addition to the commodities listed, antimony, cobalt, germanium, gold, a variety of crude nonmetallic construction materials, and carbon black are also produced, but available information is inadequate to make reliable estimates of output levels. Poland may also produce alumina in small quantities, but details of such an operation, if it exists, are not available.

[3]Reported figure.

[4]Includes building gypsum, as well as an estimate for gypsum used in production of cement.

[5]Total of listed commodities only; excludes products not reported individually as well as refinery fuel and losses.

TRADE

In 1980, the value of exports increased by 3.4% over 1979 value and reached Z51.9 billion; the value of imports increased 6.1% and reached Z57.6 billion. The deficit of the balance of payments went up to Z5.7 billion in 1980, or 39% over the 1979 total. The poor trade results were due to the unsettled situation prevailing in Poland during the second half of the year. While foreign trade increased during the first 6 months of 1980, the trade results deteriorated substantially during July through December.

The trade deficit, with the centrally planned countries, amounted to Z3 billion in contrast to a surplus of over Z1 billion in 1979. The balance of payments deficit with market economy countries was reduced to Z2.7 billion compared with the 1979 deficit of Z5.2 billion. The decline in the deficit resulted by increasing exports, while holding imports approximately to their 1979 level. Exports to market economy countries were valued at Z22.9 billion, about 10% below the planned target, and imports at Z25.6 billion.[9]

Among branches of the Polish industry, the most important in external trade was electrical and manufacturing industries. In 1980, exports by the electrical and manufacturing industries contributed about 48% of Poland's total export value; fuel and electric power, 14%; ferrous and nonferrous industry, 9%; chemical industry, 8.5%; and products of other industries, about 20.5%. The import value of manufacturing and electrical industries accounted for 35%; fuel and electrical power, 18%; ferrous and nonferrous industry, 11%; chemical industry, 12%; and products of other industries, about 24%.[10] In 1980, coal exports amounted to 31 million tons.

The value of coal export in 1980 decreased by Z1 billion (about $332 million) compared with 1979 values. There were decreases also in exports of lignite, coke, cement, copper, fertilizers, caustic soda, and sulfur.

In the second half of 1980, in comparison with the same period of 1979, exports dropped as follows: Coke—312,000 tons, copper—7,500 tons, sulfur—312,000 tons, and cement—314,000 tons.

Prices paid by Poland for raw materials imported from the U.S.S.R. (per metric ton unless otherwise specified) were as follows:

Raw material	Prices paid by Poles to Soviets		World prices	
	Zlotys	Dollars	Zlotys	Dollars
Crude oil	318	106	735	244
Iron ore	46	15	52	17
Apatite	201	67	212	70
Natural gas (per 1,000 cubic meters)	253	85	340	113
Aluminum	3,484	1,157	3,605	1,197

The prices paid by the Soviets for raw materials imported from Poland (per metric ton) follow:

Raw material	Prices paid by Soviets to Poles		World prices	
	Zlotys	Dollars	Zlotys	Dollars
Coal	170	56	--	--
Sulfur	213	71	375	125
Copper	5,291	1,758	6,306	2,095
Zinc	2,650	883	2,123	705

During 1975-80, Polish-Soviet total trade turnover reached Z147 billion (about $48.8 billion). It was approximately twice that of the 1971-75 turnover.[11]

The U.S.S.R. is the main trade partner of Poland. Poland's turnover with the Soviet Union in 1980 amounted to about Z35 billion. It comprised about 32% of Poland's total foreign turnover and about 58% of the turnover with centrally planned economy countries.[12] Soviet Union supplies constituted 38% of total Polish imports of all raw materials. Besides raw materials, Poland imported from the Soviet Union about 53,000 tons of aluminum and about 3 million tons of petroleum products in 1980. Poland balances imports from the U.S.S.R. with exports of coal, machinery and equipment, and complete industrial plants. In 1980, more than 13 million tons of Soviet oil, over 5 billion cubic meters of natural gas, and 9 million tons of iron ore were delivered to Poland. Supplies from the Soviet Union accounted for 100% of all imports of natural gas, 76% of crude oil imports, and 72% of iron ore imports. The U.S.S.R. has guaranteed to maintain the supply of crude oil, natural gas, iron ore, and other raw materials at the level of 1980 for the next 5-year period (1981-85).

In 1980, about 12% of raw materials supplied by the Soviet Union comprised materials received in exchange for Poland's participation in joint investment projects in the Soviet Union for many years. These projects included development of potassium salt in Belorussia, construction of an asbestos plant in Kiembayevsk, construction of the Orenburg gas pipeline, and building of the atomic energy power stations.

In 1980, the U.S.S.R. agreed to supply Poland with additional commodities worth $150 million and to grant Poland a 10-year low-interest credit worth $260 million. The Soviet Government has also rescheduled the repayments of the credits worth $280 million granted to Poland for the purchase of intermediate and raw materials from market economy countries.[13]

The Swedish Government has granted Poland credit guarantees to the value of 200 million crowns ($47.6 million) to enable Swedish enterprises to continue exports to Poland of industrial commodities, iron ore, and other products.

In 1980, Brazil and Poland signed a long-term contract for sulfur supplies from Poland to Brazil and supplies of Brazilian intermediate and raw materials to Poland.

The Polish Construction of Mining Projects Abroad Co. and the British Castle Brylling Rigs signed a contract under which Poland is to supply Britain with 3,500 drilling bits made by the factory of mining and drilling machines, in Garlice (Poland), in 1981. New credits for Poland were fixed by the Federal Republic of Germany. The Government is to guarantee credits totaling 300

million deutsche marks to finance exports of semifinished goods and food to Poland. Poland's debts, in deutsche marks, which mature in the first half of 1981, are put at about 500 million. In 1980, a cooperation agreement was signed in Frankfurt on the Main between the Polish Commercial Bank and a consortium of the Federal Republic of Germany. The credit worth DM400 million was granted to Poland for the development of the Lublin coal basin.

In 1980, the Energoinvest Corp. of Sarajevo (Yugoslavia) and Impexmetal of Poland signed a contract for delivery of alumina worth $31 million for the Polish aluminum industry in 1981. The major commodities that Centrozap of Poland imported from France in 1980 were spare parts for the machines and equipment installed in the Lubin copper basin, as well as spare parts to metallurgical installations imported from France.

In 1980, an agreement was signed between Impexmetal of Poland and Société Generale de Mines of Belgium for deliveries of copper to Belgium.

Table 2.—Poland: Apparent exports of selected mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Oxide and hydroxide	6	1	All to Sweden.
Metal including alloys:			
Scrap	10,610	13,362	Austria 8,200; West Germany 2,158.
Unwrought	30,374	22,332	Hungary 17,500; Japan 1,572.
Semimanufactures	264	232	Italy 173; Sweden 22; West Germany 20.
Cadmium metal including alloys, all forms	10	--	
Chromium oxide and hydroxide	309	596	Brazil 251; West Germany 114; France 85.
Copper:			
Sulfate	95	--	
Metal including alloys:			
Scrap	260	184	United Kingdom 124; West Germany 40.
Unwrought[3]	146,688	133,720	West Germany 47,835; United Kingdom 30,502.
Semimanufactures	30,600	39,471	Czechoslovakia 8,054; U.S.S.R. 6,898; United States 6,204.
Iron and steel:			
Ore and concentrate	--	77,669	Italy 73,561.
Pyrite, roasted	18,456	8,201	All to Hungary.
Metal including alloys:			
Scrap	13,566	11,408	West Germany 7,929; Yugoslavia 2,261.
Pig iron	--	3,190	Jordan 3,179.
Ferroalloys	11	--	
Steel, primary forms, thousand tons	[4]706	[4]379	Yugoslavia 179; West Germany 72; Belgium-Luxembourg 53.
Semimanufactures:			
Bars, rods, angles, shapes, sections, do.	[4]537	911	West Germany 127; Yugoslavia 21.
Plates and sheets, do.	[4]426	[4]423	West Germany 74; United States 62.
Hoop and strip, do.	[4]139	[4]147	Sweden 34; Yugoslavia 27.
Rails and accessories, do.	[4]8	[4]36	Italy 9.
Wire, do.	[4]43	[4]44	West Germany 6; Yugoslavia 6.
Tubes, pipes, fittings, do.	[4]109	[4]110	East Germany 30.[3]
Castings and forgings, rough, do.	9	10	West Germany 6; Sweden 3.
Lead:			
Oxide	242	260	All to Yugoslavia.
Metal including alloys:			
Scrap	r72	17	All to West Germany.
Unwrought[3]	500	7,098	United Kingdom 4,798; Switzerland 1,600.
Semimanufactures	r1	11	All to West Germany.
Molybdenum metal including alloys, all forms	9	5	All to Sweden.
Nickel metal including alloys:			
Scrap	210	11	All to West Germany.
Unwrought	138	--	
Semimanufactures	--	(5)	All to Yugoslavia.
Platinum-group metals and silver:			
Waste and sweepings, value, thousands	$100	$408	Switzerland $233; Austria $159.
Metals, unworked and partly worked:			
Platinum-group, do.	$1,667	$3,565	United Kingdom $1,861; West Germany $1,263.
Silver[3]	348	347	United Kingdom 132; West Germany 92; Belgium-Luxembourg 63.

See footnotes at end of table.

Table 2.—Poland: Apparent exports of selected mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Tin metal including alloys:			
Scrap	90	36	All to West Germany.
Unwrought	3	--	
Tungsten metal including alloys, all forms	9	12	Morocco 4; West Germany 4; United States 3.
Zinc metal including alloys:			
Scrap	--	24	All to West Germany.
Unwrought[3]	43,161	33,162	U.S.S.R. 13,696; Hungary 7,269.
Semimanufactures	4,931	4,782	U.S.S.R. 1,694; Czechoslovakia 1,455; West Germany 1,044.
Other metals, n.e.s.:			
Ash and residues, nonferrous	15,093	16,362	West Germany 7,019; Austria 5,757.
Oxides, hydroxides, peroxides	NA	58	Pakistan 40; West Germany 15.
Metalloids	51	1	All to West Germany.
Nonferrous alloys[3]	3,398	2,984	All to U.S.S.R.
Metal powder[3]	2,721	2,091	All to Czechoslovakia.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	119	2	All to Thailand.
Grinding and polishing wheels and stones	178	270	Egypt 148; Greece 40.
Corundum, artificial	NA	3,073	West Germany 1,849; Italy 855.
Cement[3] thousand tons	2,242	2,044	Spain 367; Austria 360; West Germany 354.
Clays and clay products:			
Crude clay:			
Fire clay[3]	26,979	24,333	Hungary 19,139; Austria 4,451.
Fuller's earth, chamotte	5,905	1,629	Hungary 1,219; Yugoslavia 410.
Other	986	8,139	Yugoslavia 5,309; Italy 2,383.
Clay products:			
Refractory[3]	15,838	18,216	Bulgaria 5,040; Albania 3,354; Belgium-Luxembourg 3,267.
Nonrefractory	2,669	3,473	Sweden 2,274; West Germany 1,038.
Diamond:			
Gem, not set or strung value, thousands	$6	$2	All to West Germany.
Industrial do	$1,300	$734	All to Belgium-Luxembourg.
Fertilizer materials:			
Crude, nitrogenous	NA	27	Australia 18; Jordan 9.
Manufactured:			
Nitrogenous[3] thousand tons	545	365	West Germany 76; France 48; India 48.
Phosphatic	3,216	--	
Potassic, potassium nitrate[3]	8,342	6,762	West Germany 1,432; Netherlands 955; United Kingdom 676.
Other, including mixed	53,555	7,476	West Germany 3,737; Ivory Coast 3,000.
Gypsum	[3]26,470	161	Sweden 160.
Iodine	3	11	West Germany 8; Yugoslavia 3.
Lime[3]	17,323	11,942	Hungary 10,017.
Pigments, mineral: Iron oxide, processed	[r]115	102	Italy 100.
Precious and semiprecious stones except diamond value, thousands	$1	$15	Switzerland $9; United States $6.
Salt[3]	307,848	253,056	Sweden 153,540; Finland 42,069; France 29,981.
Sodium and potassium compounds, n.e.s.:			
Caustic soda[3]	96,352	71,870	West Germany 26,495; Yugoslavia 9,180.
Caustic potash	3,663	20	All to Ireland.
Soda ash[3]	153,884	123,011	West Germany 43,705; Czechoslovakia 23,093.
Stone, sand and gravel:			
Dimension stone[3]	41,643	33,719	West Germany 9,409; Belgium-Luxembourg 9,141; Netherlands 6,255.
Gravel and crushed rock[3]	442,278	457,194	West Germany 334,053; Finland 52,587; Sweden 30,699.
Limestone and dolomite[3]	20,190	9,021	All to West Germany.
Sand	102,507	231,394	West Germany 221,382.
Sulfur:			
Elemental:			
Other than colloidal[3] thousand tons	4,294	3,892	U.S.S.R. 705; France 459; Czechoslovakia 443.
Colloidal	[r]1,900	72	Netherlands 32; Singapore 28.
Sulfuric acid[3]	87,411	88,310	U.S.S.R. 66,630; Switzerland 16,525.
Other nonmetals, n.e.s.:			
Crude	11,692	6,563	West Germany 6,423.
Slag, dross, and similar waste	--	410	Austria 201; West Germany 183.
Halogens	56,969	62,611	West Germany 56,205.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	--	22	All to Spain.

See footnotes at end of table.

Table 2.—Poland: Apparent exports of selected mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
MINERAL FUELS AND RELATED MATERIALS —Continued			
Coal and briquets:[3]			
Anthracite and bituminous thousand tons	40,106	41,498	U.S.S.R. 9,512; France 4,562; Finland 4,314; Italy 3,268.
Lignite do	3,332	2,974	All to East Germany.
Coke and semicoke[3] do	2,086	2,075	U.S.S.R. 722; East Germany 452; Austria 272.
Peat[3]	19,223	21,007	West Germany 10,453; Austria 3,985; Italy 3,412.
Petroleum:			
Crude 42-gallon barrels	r779	--	
Refinery products:			
Gasoline thousand 42-gallon barrels	2,194	358	Netherlands 180; West Germany 178.
Kerosine do	9	9	Hungary 8.
Distillate fuel oil do	4,329	2,643	West Germany 1,721; Sweden 568.
Residual fuel oil do	2,508	1,737	Sweden 1,254; Austria 409.
Lubricants do	128	82	Austria 74.
Other:			
Liquefied petroleum gas do	360	197	West Germany 138; Italy 25; Yugoslavia 24.
Mineral jelly and wax do	3	1	All to Netherlands.
Bituminous mixtures do	1	(5)	All to Sweden.
Unspecified[3] do	4,685	6,101	Denmark 2,779; Switzerland 911.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	69,232	55,895	West Germany 26,574; France 14,133.

rRevised. NA Not available.

[1]Owing to the lack of official trade data published by Poland, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from various sources which include United Nations information, data published by the trading partners, and partial official trade sources of Poland.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Official trade statistics of Poland.

[4]United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[5]Less than 1/2 unit.

Table 3.—Poland: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite[3]	100,558	95,074	Hungary 75,480; Australia 19,594.
Oxide and hydroxide[3]	311,209	283,038	Hungary 102,731; Yugoslavia 93,538; United States 81,071.
Metal including alloys:			
Unwrought	29,759	23,743	Hungary 20,013; Norway 2,159;[4] Greece 1,393.
Semimanufactures[3]	39,710	33,496	U.S.S.R. 7,759; Romania 6,718; Czechoslovakia 4,779.
Bismuth metal including alloys, all forms	2	5	All from Japan.
Chromium:			
Chromite[3]	198,540	211,248	U.S.S.R. 142,700; Albania 35,085.
Oxide and hydroxide	6	4	All from United Kingdom.
Metal including alloys, all forms	--	21	France 20.
Cobalt:			
Oxides and hydroxides	--	9	All from United States.
Metal including alloys, all forms	4	24	United States 21.
Copper metal including alloys:			
Unwrought	[3]589	[5]100	NA.
Semimanufactures[3]	6,237	2,836	Czechoslovakia 900; West Germany 805.
Iron and steel:			
Ore and concentrate[3] thousand tons	17,198	18,872	U.S.S.R. 13,447; Sweden 2,481; Brazil 2,418.
Metal including alloys:			
Scrap thousand tons	[6]9	[6]6	NA.

See footnotes at end of table.

Table 3.—Poland: Apparent imports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Iron and steel —Continued			
Metal including alloys —Continued			
Pig iron thousand tons	[3]1,710	[6]1,463	U.S.S.R. 1,247;[3] West Germany 112.
Ferroalloys[3] do	108	99	Norway 43; U.S.S.R. 20; Switzerland 14.
Steel, primary forms do	[6]31	[6]17	Czechoslovakia 9; Yugoslavia 8.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	[6]709	[6]593	West Germany 42; United Kingdom 25.
Plates and sheets do	[6]761	[6]830	West Germany 127; Czechoslovakia 126; U.S.S.R. 65.
Hoop and strip do	[6]89	[6]96	West Germany 50; Austria 17.
Rails and accessories do	[6]119	[6]39	Yugoslavia 9.
Wire do	[6]47	[6]49	Belgium-Luxembourg 3; West Germany 2.
Tubes, pipes, fittings do	[6]325	[6]337	France 34; Romania 34; West Germany 33.
Castings and forgings do	[6]53	[6]39	NA.
Lead:			
Ore and concentrate	33,774	--	
Oxide	297	421	France 399.
Metal including alloys:			
Unwrought[3]	9,580	9,805	Australia 5,398; U.S.S.R. 4,006.
Semimanufactures	--	1	All from Yugoslavia.
Magnesium metal including alloys:			
Unwrought[3]	1,789	1,370	Norway 953; United States 337.
Semimanufactures	--	1	All from West Germany.
Manganese:			
Ore and concentrate[3]	651,414	739,889	U.S.S.R. 521,463; France 139,353.
Oxides	1,675	1,417	Ireland 760; Greece 560.
Metal including alloys, all forms	79	--	
Mercury 76-pound flasks	5,592	957	All from Turkey.
Molybdenum:			
Ore and concentrate	169	90	Netherlands 85.
Metal including alloys, all forms kilograms	--	20	All from Switzerland.
Nickel metal including alloys:			
Unwrought	168	99	Belgium-Luxembourg 48; West Germany 40.
Semimanufactures	345	107	West Germany 49; United Kingdom 19.
Niobium metal including alloys, all forms kilograms	--	198	All from West Germany.
Platinum-group metals including alloys, unworked or partly worked value, thousands	$3,492	$4,704	Switzerland $3,551; West Germany $1,142.
Silver metal including alloys, unworked or partly worked do	$908	$1,454	France $852; West Germany $376.
Tantalum metal including alloys, all forms kilograms	--	1,466	All from United States.
Tin metal including alloys:			
Unwrought[3]	4,616	3,879	United Kingdom 2,447; Indonesia 750.
Semimanufactures	--	1	All from West Germany.
Titanium:			
Oxide	2,016	1,174	United Kingdom 628; West Germany 472.
Metal including alloys, all forms kilograms	--	970	Italy 500; Japan 470.
Tungsten:			
Ore and concentrate[3]	4,103	2,898	United Kingdom 1,721; Switzerland 246.
Metal including alloys, all forms kilograms	1,742	2,579	United States 1,093; Japan 973.
Zinc:			
Concentrate[3]	28,640	27,979	West Germany 20,281; Norway 7,698.
Oxide and peroxide	10	22	United Kingdom 21.
Metal including alloys:			
Unwrought[3]	2,520	2,627	U.S.S.R. 2,043.
Semimanufactures	[7]56	229	Belgium-Luxembourg 200.
Other metals, n.e.s.:			
Ores and concentrates	68,190	153	Austria 97; United Kingdom 50.
Ash and residue, nonferrous	125	10	All from Canada.
Oxides, hydroxides, peroxides	--	146	West Germany 122; France 10.
Metalloids	1,791	18,269	France 15,135; Yugoslavia 1,434.
Metal powder[3]	885	644	All from East Germany.
Nonferrous alloys[3]	383	993	All from U.S.S.R.
Base metals, all forms	137	88	West Germany 61; Austria 15.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	733	675	Italy 623; Greece 51.
Dust and powder of natural or synthetic precious or semiprecious stones value, thousands	$660	$686	All from Belgium-Luxembourg.
Grinding and polishing wheels and stones	3,702	2,064	Austria 653; United Kingdom 624; Yugoslavia 310.
Corundum, artificial	NA	4,145	Yugoslavia 2,133; United Kingdom 1,070.

See footnotes at end of table.

Table 3.—Poland: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Asbestos[3]	102,376	103,372	U.S.S.R. 45,217; West Germany 26,707; United Kingdom 16,348.
Barite and witherite	[3]21,653	1,125	All from Ireland.
Boron:			
Crude natural borates	[r]6,085	19,707	Turkey 18,775.
Boric oxide and acid	[r]4,210	1,801	Turkey 1,245; France 556.
Cement[3]	285,529	42,318	U.S.S.R. 42,313.
Clays and clay products:			
Crude:			
Bentonite	3,962	4,053	Hungary 4,002.
Fire clay[3]	[r]28,942	63,299	U.S.S.R. 49,367; Spain 6,909.
Chamotte[3]	[r]15,521	48,404	France 34,372; U.S.S.R. 8,294.
Kaolin[3]	185,221	218,032	United Kingdom 94,117; Czechoslovakia 61,249; U.S.S.R. 28,163.
Clay products:			
Refractory[3]	68,473	52,432	West Germany 8,917; Ireland 8,611; Yugoslavia 8,586.
Nonrefractory	3,263	7,394	Spain 3,732; Italy 2,290.
Diamond:			
Gem, not set or strung value, thousands	$273	$375	Belgium-Luxembourg $325.
Industrial do.	$6,139	$7,260	Belgium-Luxembourg $7,119.
Diatomite and other infusorial earth	174	703	United States 546; France 157.
Feldspar and fluorspar[3]	86,640	62,553	East Germany 19,491; Mexico 18,524.
Fertilizer materials:			
Crude, phosphatic[3] thousand tons	3,255	3,327	Morocco 1,186; United States 763; U.S.S.R. 636.
Manufactured:			
Nitrogenous[3] do.	[r]535	207	U.S.S.R. 157; Hungary 49.
Phosphatic do.	--	3	All from France.
Potassic[3] do.	2,436	1,789	U.S.S.R. 1,109; East Germany 641.
Other, including mixed	2,978	330	All from Belgium-Luxembourg.
Ammonia[3]	98,733	80,647	U.S.S.R. 39,033; Hungary 24,452; Austria 12,967.
Graphite[3]	11,906	13,828	Austria 9,815; U.S.S.R. 3,636.
Gypsum and plasters	6,776	8,864	West Germany 8,622.
Lime	--	10	All from France.
Magnesite[3]	316,668	319,921	North Korea 121,259; Brazil 59,911; Czechoslovakia 58,635.
Mica, all forms[3]	1,641	1,756	India 1,613.
Pigments, mineral:			
Natural, crude	--	19	All from United States.
Iron oxides, processed	2,921	3,031	West Germany 1,699; Canada 1,295.
Precious and semiprecious stones except diamond value, thousands	$274	$564	West Germany $252; Switzerland $200.
Pyrite	--	59	All from Italy.
Salt	78	--	
Sodium and potassium compounds, n.e.s.:			
Caustic soda	--	15	All from West Germany.
Soda ash[8]	36,100	16,300	NA.
Stone, sand and gravel:			
Dimension stone[3]	[r]7,258	4,627	Bulgaria 2,327; Albania 929; U.S.S.R. 881.
Gravel and crushed rock[3]	[r]15,599	16,725	Norway 13,924; Finland 2,672.
Limestone and dolomite	[3]11,130	[9]14,468	Hungary 14,264;[3] West Germany 190.
Quartz and quartzite	3,440	6,518	West Germany 5,717; Brazil 700.
Sand	94	98	Sweden 33; Netherlands 20; United States 17.
Sulfur:			
Elemental	--	26	Austria 24.
Sulfuric acid	--	961	United Kingdom 950.
Talc[3]	25,540	26,043	Czechoslovakia 6,690; Finland 6,442.
Other nonmetals, n.e.s.:			
Crude	15,181	19,043	Hungary 13,971; West Germany 4,978.
Halogens	211	267	Japan 89; West Germany 67; France 50.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	47	West Germany 45.
Carbon black	6,993	15,029	West Germany 8,181; France 2,307; United Kingdom 2,196.
Coal, anthracite and bituminous[3] thousand tons	1,074	971	U.S.S.R. 686; East Germany 285.
Coke and semicoke	364	14,494	All from Netherlands.
Gas, natural[3] million cubic feet	97,221	140,658	All from U.S.S.R.
Petroleum:			
Crude[3] thousand 42-gallon barrels	122,147	122,368	U.S.S.R. 95,205; Iraq 13,989.

See footnotes at end of table.

Table 3.—Poland: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum —Continued			
Refinery products thousand 42-gallon barrels	25,650	29,299	U.S.S.R. 19,360; Romania 640; Albania 346.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	--	1,481	West Germany 1,241.

[r]Revised. NA Not available.

[1]Owing to a lack of official trade data published by Poland, this table should not be taken as a complete presentation of this country's mineral imports. These data have been compiled from various sources which include United Nations information, data published by the trading partners, and partial official trade sources of Poland.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Official trade statistics of Poland.

[4]Metallgesellschaft AG. Metallstatistik, Druckerei C. Adelmann, Frankfurt am Main, 1980.

[5]World Bureau of Metal Statistics. World Metal Statistics, London.

[6]United Nations. Quarterly Bulletin of Steel Statistics for Europe, New York.

[7]Partial figure; tonnage not available for all trading partners.

[8]Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow.

[9]Official trade statistics of Poland report imports of 14,267 tons of limestone and dolomite, and official trade statistics of individual trading partners report exports of 201 tons of dolomite to Poland.

COMMODITY REVIEW

METALS

Aluminum.—The production of aluminum in Poland is based on alumina imported mainly from Hungary and Yugoslavia. In 1980, production of aluminum was 3,000 to 4,000 tons short of what was originally planned. The smelters of Skawina and Konin each have an annual capacity of 50,000 tons per year. The shortfall was entirely due to a shortage of coal to produce the huge amount of power needed to produce aluminum. Reportedly, the Skawina plant, near Krakow, is to be closed down because of its pollution and deleterious effects on the environment and because of its high consumption of energy. Output of aluminum is expected to fall considerably in 1981, and imports of aluminum metal are expected to increase. Two new methods for aluminum extraction from non-alumina raw materials, such as fly ash from the Turow power station and overburden clays from Turoszow brown coal open pit mine, continued to be under research in 1980.

Copper.—It was originally planned that in 1980 the copper plants would deliver 425,000 tons of refined copper, and in 1983 about 500,000 tons. According to Polish reports, the new copper production target for 1980 was set at 390,000 tons.

However, the new production plant was not fulfilled because of strikes which started in August and continued in September 1980. The miners of the Legnica-Glogow Copper Basin demanded an immediate return to the traditional three-shift working day, and a reduction of the working week to 5 days in the coming years. Meeting the demands of the miners would mean a decrease in the extraction of copper ore by over 6.5 million tons per year and in the production of electrolytic copper by about 90,000 tons. However, the Polish Government announced on October 1, 1980, a return to the three-shift system for the copper miners in the Legnica-Glogow Copper Basin. The agreement also provided for a 5-day week.

According to Polish sources, the downward trend in copper production is expected to continue in 1981. In 1980, due to labor strikes, Poland could not fulfill all the copper export contracts.

In 1980, copper ore was mainly extracted from the Lubin, Polkowice, and Rudna Mines, located in the Legnica-Glogow Copper Basin. Development of the Sieroszowice copper mine, located in the same area, continued in 1980.

The first shaft of the mine was completed at the depth of 750 meters in August 1979;

when the first stage of development of the Sieroszowice Mine is completed in 1983, the mine is to produce 5.5 million tons of ore per year.[14] Projected mine capacity is 15 million tons of ore per year. The Rudna Mine, which started operating in June 1974, with a planned capacity of 12 million tons, produced 2.2 million tons of copper ore in the first 3 months of 1980. The copper ore deposits in the Legnica-Glogow Copper Basin lie at depths 600 to 1,200 meters below the surface and consist of sulfide ores. The average copper content was estimated at 1.4% to 1.5% in 1980. According to the Central Geological Office, it is believed that the deposits of copper ore will last about 35 to 40 years at the planned rate of production.

Poland's Orsk plant has produced only 7,500 tons of rolled copper since it came onstream in May 1979. The Orsk plant has a capacity of 100,000 tons per year of rolled copper wire.

In 1980, the Polish Impexmetal of Warsaw and the Belgian Société Generale de Mines signed a contract for the delivery of 42,000 tons of copper to Belgium between 1981 and 1984.[15]

In the same year, the Federal Republic of Germany's consortium had agreed to take 480,000 tons refined copper for 1979-90, in addition to the 40,000 tons per year agreed for 1977-88.

Gold.—The Geological Institute of Warsaw has begun a study of the possibilities of producing gold in Poland from old mines. Prospecting for new deposits of gold-bearing material is planned to be concentrated in Lower Silesia.[16] A concentration of 100 milligrams of gold per cubic meter of material is the minimum economic amount for a start-up of mining operations in Poland. Polish industry uses about 2.5 tons of gold per year. The use of gold in industry has been increasing sharply in recent years. Reportedly, it is possible to recover 1.5 tons of gold per year from waste. The copper ore of the Lubin-Glogow deposit contains gold, and it is estimated that it could yield annually (in addition to 400,000 tons of copper) about 40 tons of gold, currently worth about $800 million. Production of gold, however, would require great investment.

Iron and Steel.—Poland's steel production for 1980 was well below the planned 22.2 million tons. Ferrous metallurgy was hard hit by power interruption due to a shortage of coal at powerplants.[17] There had been 58 days of power restriction during the 98 working days between September 1 and December 6. Production losses during this period amounted to 1 million tons of crude steel and 611,000 tons of rolled products.

In 1980, Z30,100 million was allocated for the development of metallurgy. One of the biggest metallurgical plants in Krakow, the Lenin Metallurgical plant, which produces over 6.5 million tons per year, produced the 100 millionth ton of steel at yearend 1980.

The major overhaul of the No. 1 blast furnace of the Lenin iron and steel enterprise was completed in 1980. The Lenin plant employs about 40,000 people. In 1980, the second stage of construction at the Katowice metallurgical plant continued. In 1981, however, there will be limitation in the volume of investment for expansion of Katowice Steel complex and for several other steel industry projects. Only Z8,300 million is earmarked in the steel industry for 1981. The plan for 1981 foresaw a steel output of 17.7 million tons.

In 1980, Poland's Nowotko plant was building an 800,000-ton-per-year mill to produce cold-formed sections. The Polish steel industry is almost entirely dependent upon imported iron ore. Imports of iron ore and concentrate from the U.S.S.R. were about 9 million tons in 1980. Under agreement signed in 1975, Poland has to deliver to Brazil 33 to 36 million tons of hard coal between 1975 and 1990, and Brazil is to supply Poland with 33 million tons of iron ore during the same period.[18]

In 1980, exploration of the magnetite iron ore deposits continued in northeast Poland. Development of an underground mine, with an initial annual capacity of 8 million tons of iron per year, is to begin at Krzemionka, near Suwalki. The iron ore deposits are at a depth of 2,000 meters. The ore contains some quantities of titanium and vanadium of industrial value, as well as containing 27% iron.[19]

Lead and Zinc.—Poland has long been one of the largest zinc-producing countries in the world. As a result of strikes, production of refined zinc and lead was 4,000 to 5,000 tons short of the planned amount for each metal in 1980.

In 1980, there were three major lead-zinc mines in operation—Boleslaw, Olkusz, and Pomorzany—all located in the Katowice area.

To increase zinc production, Poland hopes to start using slag with a content of about

5% to 6% zinc. Poland imports about 15% of its zinc requirements in the form of 50% zinc concentrate from Peru, Canada, Mexico, and Norway.

It is also planned to increase lead-zinc production in the future from deposits discovered in the Olkusz-Chrzanow and Zawiercie regions. In the Zawiercie region, Poland plans to develop one mine with a capacity of 2.5 million tons of ore per year and another mine with a capacity of 1 million tons after 1980.

Poland's second Imperial Smelting Furnace at Miasteczko Slaskie was completed in the beginning of 1980. The furnace is to produce 52,000 tons per year of zinc and 23,000 tons per year of lead, using local concentrates.

In 1978, a decision was made to close the shaft furnace in the lead production at Szopience because of its pollution of the environment. However, the shaft furnace continued to be in operation and produced 140 tons of lead compounds in 1980.

Nickel.—In 1980, Poland continued to produce nickel ore at Zabkowice Slaskie from weathered peridotite. The ore contained 0.7% to 1% nickel metal. Domestic production of nickel metal meets about 30% of the national requirements.

Silver.—Production of silver is becoming one of Poland's major hard currency earners.[20] In 1980, production of silver did not increase considerably compared with the 1979 level. Practically all of Poland's silver was obtained as a byproduct of copper production. It is not known what proportion of the silver produced is put aside for currency purposes. In 1979, the income from exporting silver was 45% of income obtained from the sale of copper. Export of silver amounted to Z327 million in 1979.[21] Export of silver in 1980 was estimated at Z515 million. The silver is sold mainly in Western Europe.

Tin.—In 1979, some tin deposits of economic value were discovered in the Krobnica region near Swieradow-Zdroj (Lower Silesia). The probable resources were estimated at about 25 million tons of tin ore. Further prospecting of the deposits continued in 1980.

NONMETALS

Cement.—In December 1980, the shortages of fuel and other materials caused 70 of the 91 available furnaces for the cement industry to be put out of operation. Production of cement was less than planned by 2.6 million tons. It was expected that the January 1981 supplies would barely meet half the cement industry's need. At the end of 1980, the cement factories in Kielce Province substantially reduced output of cement because of a shortage of coal, heavy oil, and because of power cuts. The plant Nowiny-1 was shut, the Novini-2 was working at 50% capacity, and the Malogoszcz was working at 25% capacity. At the Lublin cement combine in Chelm, production was also decreased due to the coal shortages.

Poland's total cement production capacity in 1980 was estimated at 25 million tons. However, internal conditions permit utilization at only 84% to 88% of production capacity.[22]

Polish cement demand is expected to be 277 million tons in 1985.

Fertilizers.—The revised 1980 plan provided, in terms of nutrient content, 1.28 million tons of nitrogenous fertilizers and 845,000 tons of phosphoric fertilizers. The original goals for 1980 were 2.2 and 1.3 million tons, respectively. The revised 1980 plan for nitrogenous fertilizer was fulfilled; however, production level was lower than that of 1979. The shortage in nitrogenous fertilizer production was due to a breakdown at the Wloclowek nitrogen plant, one of the three main fertilizer plants. The production section of this plant was shut down for extensive repairs. Operating rates at the Pulawy nitrogen complex were reduced by 30% due to a shortage in gas supplies. Production of phosphoric fertilizer was below the revised planned target by approximately 2.5 thousand tons.

The plants in Police and Gdansk, located in the neighborhood of seaports, underwent stoppages because of strikes, while the plants in Libon, Ubocz, and Banarka had shortfalls owing to a lack of phosphoric raw materials, which stayed on board ships.[23]

In 1980, consumption of fertilizers per hectare of area was reported as 192 kilograms; this was much less than planned. Plans are to increase fertilizer consumption to 230 kilograms per hectare in 1985.

In 1980, the U.S.S.R. delivered about 1 million tons of potash fertilizer to Poland, with the remainder from the German Democratic Republic and Belgium. Potash consumption in Poland fell considerably in 1980. Apatite concentrate and phosphorites were imported mainly from the U.S.S.R. and Morocco.

The Police 11 ammonia/urea and ammo-

nium phosphates complex continued under construction in 1980 (due for completion in 1983). Occidental Petroleum has agreed to supply fertilizers, chemicals, and other agricultural products to Poland, following a visit by the Occidental Petroleum Chairman.

Salt.—Poland possesses some of the world's richest deposits of rock salt. The oldest salt mines are located in Wieliczka and Bochnia; however, the salt mine in Wieliczka is not an economically important center. Of greater economic importance in 1980 were the salt mines in Inowroclaw, Klodawa, and Wapno.

In 1980, there were 12 salt mines and plants in operation in Poland, with average employment of about 5,000 people. The Klodawa Mine in Konin Province, the biggest salt mine in the country, was to produce 1.5 million tons of rock salt in 1980, about 23,000 tons more than in 1979. However, the plan was not fulfilled as the expansion and modernization of the enterprise were delayed.

Sulfur.—Polish sulfur production is concentrated in the Tarnobrzeg region. In 1980, sulfur was surface mined at the Machov-Piaseczno Mine, while the Frasch process was used at the Grzybow and Jezierko Mines. Sulfur was obtained by the Frasch process at the depth of 40 to 180 meters. In 1980, it was reported that the experimental Baszina Mine in the Preusl region produced 70,000 tons of sulfur during the trial operation and that preparations for exploitation of the second working area of this mine were to start in 1981. Tarnobrzeg ore contained 16% to 35% sulfur; ore reserves were estimated at 100 million tons.[24]

According to a report from Warsaw, plans were announced to double the production of sulfur in the Tarnobrzeg Basin in the near future.

Sulfur production in 1980 was below the target. Approximately 2,000 workers at the open pit mines and processing plant at Machow went on strike September 3, 1980, and a week later, the Polish sulfur industry was reported to be paralyzed. The workers wanted all the benefits of coal miners plus a 15% supplement for unhealthy work with sulfur. Total exports of sulfur from Poland in 1979 dropped by 10% compared with that of 1978, as a result of production problems experienced during the year. The drop in Polish sulfur exports during 1979 occurred completely with the developed market economy countries; exports to the centrally planned countries increased by 5%. Sulfur exports from Poland during the first half of 1980 showed an improvement on 1979's half-year deliveries of sulfur. However, September's labor strikes lowered the total sulfur production and exports in 1980. Sulfur exports fell by 312,000 tons in 1980, compared with the 1979 level.

In the beginning of 1980, the first stage of a new railway was completed between the iron ore producing region of Vladimir Volynski in the U.S.S.R. and the Polish metallurgical complex at Katowice. The line was used to transport Soviet iron ore to Poland in exchange for Polish coal and sulfur from the Slask and Tarnobrzeg regions.[25]

In September 1980, Brazil signed a $150 million loan for deliveries of sulfur from Poland. Poland will supply Brazil with 4 million tons of sulfur during the next 10 years. Deliveries are scheduled to start in 1981, with 220,000 tons per year to increase gradually to 350,000 tons annually by 1991. The loan from the Government of Brazil has been granted to finance the development of Poland's new sulfur mine at Baranow. This mine is scheduled to come onstream in 1983.[26]

It is expected that Occidental will provide credit for additional sulfur development in Poland. Occidental agreed that annual production of the mine will be reduced from the proposed 1.5 million tons to 1 million tons. It is expected that an agreement on this transaction will be concluded in March 1981. With a 10-year contract, Occidental would extend to Poland credit worth about $750 million and would consider the credit as a direct investment in developing new Polish sulfur deposits, stressing that 30% to 50% of the extracted sulfur is to be delivered to Occidental at production cost. However, Poland claims the credits represent only an advance payment for sulfur deliveries.

MINERAL FUELS AND RELATED MATERIALS

Coal is the principal source of energy in Poland. In 1980, the total primary energy production was 216.3 million tons in standard coal equivalent (SCE). This represents a decrease in total primary energy production by 4.3%, compared with the 1979 level. Coal (lignite and bituminous) contributed 94.4%; crude oil, 0.2%; natural gas, 3.9%; and others (peat, wood, and hydropower), 1.5%. Total consumption of all types of primary energy reached 219.6 tons SCE, with coal providing 78.4%; petroleum, 13.1%; nat-

ural gas, 7%; and about 1.5% for others. In 1980, the total apparent consumption of primary energy increased 1.6% over consumption of 1979; however, exports decreased by 23.7%. The energy balance for 1980 and 1979 is shown in table 4.

Table 4.—Poland: Total primary energy balance for 1980 and 1979

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (lignite, bituminous) and coke	Crude oil and petroleum products	Natural gas	Others
1980:					
Production	216.3	204.2	0.5	8.4	3.2
Imports	38.8	1.0	30.7	7.1	--
Exports	35.5	33.1	2.4	--	--
Apparent consumption	219.6	172.1	28.8	15.5	3.2
1979:					
Production	226.1	212.4	.5	9.8	3.4
Imports	36.6	.9	30.4	5.3	--
Exports	46.5	44.2	2.3	--	--
Apparent consumption	216.2	169.1	28.6	15.1	3.4

[1]One ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are from the United Nations as follows: Hard coal, 1.0; brown coal, 0.3; coke, 0.9; crude oil, 1.47; petroleum products, 1.54; natural gas (1,000 cubic meters), 1.33.

Source: Biuletyn Statystyczny (Statistical Bulletin), Warsaw. No. 1, 1981, pp. 14, 30, and 32. Rocznik Statystyczny (Statistical Yearbook), Warsaw, 1980, p. 142.

Coal.—As a result of the strike, extraction of bituminous coal in 1980 was about 13 million tons short of total planned. However, supplies of coal to the population increased by 1.8 million tons compared with the provisions of the plan. In 1980, supplies of coal to the power industry amounted to 60 million tons, which was 600,000 tons more than planned, and 4.8 million tons more than supplied for 1979.

In 1981, output of bituminous coal is planned to be 170 to 172 million tons, with Saturday output considered above plan.[27] Saturday output is estimated to be 16 to 18 million tons of coal. Total output of bituminous coal was originally planned at 210 to 212 million tons for 1981.

In 1980, Poland failed to fulfill foreign contracts for 12.2 million tons of coal. Poland's coal exports in 1980 totaled 31 million tons, 10.4 million tons less than in 1979. Because coal amounts to about 12% of Polish total exports, the shortfall caused a serious deficit in Poland's hard currency earnings.

In 1979, Poland exported 14.9 million tons of coal to centrally planned economy countries; 9.5 million tons went to the U.S.S.R., and 26.5 million tons went to developed countries. In 1980, Polish coal exports to the Soviet Union amounted to about 5 million tons. Finland, Denmark, France, Italy, and the Federal Republic of Germany are the largest West European recipients of Polish coal. Finland is most dependent; about 91% of its imports of coal comes from Poland. Denmark is second with over 41%. In 1981, export of coal is planned to be about 21 million tons.[28]

In 1980, Poland operated 66 coal mines. There were 320 completely mechanized longwall faces in operation. Average mining depth was estimated at 550 meters. Extraction of coal started at the Halemba Gleboka Mine in Ruda Slaske at a depth of 1,030 meters. The first longwall in operation is to supply 2,000 tons per day. The development of new mines continued in 1980. Among the new mines under development are the Suszec, Kaczyce, Czeczot, and Orantovice Mines. The Suszec Mine is to have four shafts. The first shaft reached the planned depth in 1980. The Kaczyce Mine is planned to be 1,100 meters in depth. In 1980, three shafts were under sinking at the mine. The second shaft reached a depth of 560 meters, and the first shaft reached 800 meters in July 1980. The first coal is to be produced in 1983, and by 1987 the mine is to produce 6,000 tons per day. Development of the Orantovice Mine started in 1978. In 1980, four shafts were under construction, each of which was 9 meters in diameter. It is expected to yield 20,000 tons per day from seams 1,000 and 1,500 meters deep in the 1990's.

Eight miners were killed and 18 injured—

4 seriously—in an accident which occurred at the Halemba coal mine in Ruda Slaska on September 1.

Work was continuing in the new Lublin Hard Coal Basin in 1980. The Lublin Basin in the east of Poland covers over 4,000 square kilometers and its development started in 1975. The mines will be over 800 meters deep. The first to be developed is the central coal region with recoverable reserves of 2.6 billion tons, covering the area of 240 square kilometers.[29]

Geological and preparatory work in the Lublin Basin were completed in 1980. More than Z7.5 billion was invested in the development at the Bogdanka and Stefanow Mines in the Lublin central coal region. With the completion of the first stage of the project scheduled for 1990, the annual output is to reach 20 million tons. In 1980, the development plan for the Lublin Coal Basin was cut back; only three mines are to be developed at the Basin in the near future. Plans are to continue development of the Bogdanka Mine, to resume development of the K-2 Mine in 1983, and to begin development of the K-3 Mine in 1985.[30] The coal seams in the Lublin Basin are about 1.0 to 2.0 meters thick and are comparatively flat. The coal is of steam quality.

In 1980, Poland signed an agreement with the Federal Republic of Germany's Krupp-Kopper to build a small $140 million coal gasification plant near a coal mine outside of Katowice. The facility will use the Federal Republic of Germany's technology and equipment. The plant is to produce 950 million cubic meters of gas per year for home and industrial heating. Construction is to begin in 1982, with startup planned for 1984.

Poland is one of the world's largest producers of lignite, which is used mainly by local electric power stations. Lignite production was planned to reach 42 million tons in 1980, but the extraction of lignite was much below the planned target. The shortfall in production was aided by the strikes in Poland.

The Turnow Basin's surface-mined output accounted for about 60% of the total lignite production in 1980. On November 20, 1980, miners reached the first lignite seam at a depth of 93 meters at Belchatow Basin. The Belchatow project includes two power stations, each with a generation capacity of 4,300 megawatts. Belchatow is to have an annual capacity of 40 million tons per year when it is fully developed. The Basin's lignite reserves are said to total 1,250 million tons.

Natural Gas.—In 1980, production of indigenous gas declined slightly; about 5.3 billion cubic meters of natural gas was imported from the U.S.S.R.[31] Under a 20-year agreement, Poland is to receive 2.8 billion cubic meters of natural gas per year in return for the investment made in constructing the Soyuz pipeline from the U.S.S.R. Poland expects to participate in construction of U.S.S.R., Polish, and German Democratic Republic sections of the proposed new Northern gas pipeline to receive additional deliveries of gas. For the coming years, it is expected that a further decrease will take place in the supply of natural gas from indigenous fields with large amounts of methane, while supplies of gas containing nitrogen will increase. A new field supplying natural gas containing nitrogen was opened for exploitation in 1979. A future rise in gas imported from the U.S.S.R. is expected.

Nuclear Energy.—The first nuclear power station in Poland is to be put into service at Zarnowice, Gdansk Province. It is to have two 440-megawatt units and one 1,000-megawatt unit. The first 440-megawatt unit is to start operations in 1986, but owing to delays in preparatory work which was planned to start in the first quarter of 1980, this target date will not be met. The second nuclear power station project will be the Kujawy station, near Wloclawek, on the Vistula. The station will consist of four 1,000-megawatt units. Under a cooperation agreement with the CMEA countries, deliveries of equipment for the station should begin in 1986 and be completed in 1990. In the years 1986-90, construction is to begin of two nuclear power stations, which should go into operation between 1991 and 2000. The nuclear fuel for the Polish power stations is to be imported from the U.S.S.R. Poland is participating in the construction of three nuclear powerplants in the U.S.S.R.

Petroleum.—Production of crude oil in Poland is relatively insignificant. In 1980, oil imports from the U.S.S.R. were planned to be about 15.9 million tons, including 2.8 million tons of products and 1.1 million tons of crude oil as payment for Polish construction of an oil pipeline in the U.S.S.R. However, there was a delay in supply of crude oil due to strikes in Poland. Imports from the U.S.S.R. account for about 76% of crude

oil used by Polish industry.

In recent years, imports of oil from the Organization of Petroleum Exporting Countries have been increasing, and this trend will continue in the coming years. In 1979, the Nigerian and Polish Governments signed an agreement under which Nigeria is to deliver to Poland 0.5 million tons per year of crude oil at current world prices. It is expected that Poland will use about 30 million tons of crude oil in 1985. For the first time in the 5 years of its existence, Gdansk refinery failed to meet its annual crude oil processing and sales targets. In 1980, the sale of petroleum products by the refinery was 6% less than planned. This was due to a shortfall in the supplies of oil for processing. Modernization of the Gdansk refinery continued in 1980. This will include change in production structure. The variety of petroleum products at the Gdansk refinery is planned to be increased. The Plock refinery processed about 13 million tons of crude oil and fulfilled the 1980 plan.

Poland planned to explore its Baltic seabed for oil and gas. The first stage of drilling for oil and gas started at the northern Port of Gdansk in 1980. The first borehole is to be 3,000 meters deep. The Petrobaltic Enterprise's platform was equipped for drilling down to a depth of 6,000 meters, with a water depth of 90 meters.[32]

In 1980, intensified exploration has resulted in the discovery of new oilfields near Karlin in the Koszalin region, northwest Poland. The fields were estimated to contain about 1.5 to 2 million tons of oil.

Poland's most productive deposits of oil are located near Kamien Pomorski, where oil is extracted from a depth of 2,300 meters. Wysoka Kamienska is another major source of oil. There are also smaller deposits of oil in Western Pomerania. In 1980, exploration for oil and gas continued in the Polish lowlands.

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[1]Foreign mineral specialist, Branch of Foreign Data.
[2]Trybuna Ludu, Warsaw. Feb. 5, 1981, p. 3.
[3]Depending upon the purpose of the exchange, the value of the zloty may vary considerably. Where necessary, values have been converted from Polish zloty (Z) to U.S. dollars at the official exchange rate of Z3.01 = US$1.00 (basic rate), Z19.92 = US$1.00 (special commercial rate).
[4]Concise Statistical Yearbook of Poland, Warsaw. 1980, p. 104.
[5]CMEA-Council for Mutual Economic Assistance comprised of Bulgaria, Cuba, Czechoslovakia, German Democratic Republic, Hungary, Mongolia, Poland, Romania, U.S.S.R., and Vietnam. Yugoslavia has associate status with limited participation, but is normally not included for statistical purposes.
[6]Contemporary Poland (Warsaw). No. 6, March 1980, pp. 1-4.
[7]Polish Foreign Trade (Warsaw). February 1980, pp. 2-3.
[8]Contemporary Poland (Warsaw). No. 1, 1981, p. 7.
[9]Trybuna Ludu (Warsaw). Jan. 22, 1981.
[10]Biuletyn Statystyczny (Statistical Bulletin) (Warsaw). No. 1, January 1981, p. 29.
[11]Trybuna Ludu (Warsaw). Oct. 8, 1980, pp. 3-6.
[12]Page 28 of work cited in footnote 10.
[13]Polish Economic Survey (Warsaw). No. 20, 1980, p. 2.
[14]Polish Economic Survey (Warsaw). No. 19, 1980, p. 11.
[15]Polish Economic Survey (Warsaw). No. 16, 1980, p. 12.
[16]Cuprum (Copper) (Wroclaw). No. 3, 1979, p. 32.
[17]Trybuna Ludu (Warsaw). Dec. 9, 1980, p. 7.
[18]Polish Foreign Trade (Warsaw). No. 9-10, 1980, p. 6-8.
[19]Wiadomosci Gornicze (Mining News) (Warsaw). No. 7, p. 183.
[20]Trybuna Ludu (Warsaw). Apr. 27, 1980, p. 1.
[21]Rocznik Statystyczny Handlu Zagzanicznego (Polish Trade Book) (Warsaw). 1980, p. 79-80.
[22]Cement, Wapno, Gips (Cement, Lime, Gypsum) (Warsaw). No. 5, May 1980, pp. 116-119.
[23]Zycie Gospodarcze (Economic Life) (Warsaw). Oct. 26, 1980, pp. 8, 9.
[24]Geologicky Pruzkum (Geological Investigations) (Prague). No. 3, 1980, p. 82.
[25]Sulfur (London). No. 146, January-February 1980, p. 17.
[26]Sulfur (London). No. 150, September-October 1980, p. 7.
[27]Trybuna Ludu (Warsaw). Jan. 29, 1981, p. 1.
[28]Trybuna Ludu (Warsaw). Jan. 13, 1981, p. 2.
[29]Zycie/Gospodarcze (Economic Life) (Warsaw). No. 29, July 20, 1980, p. 4.
[30]Trybuna Ludu (Warsaw). Nov. 28, 1980, p. 2.
[31]Foreign Trade (Moscow). No. 9, 1980, p. 26.
[32]Contemporary Poland (Warsaw). No. 16, August 1980, p. 18.

The Mineral Industry of Portugal

By Roman V. Sondermayer[1]

As in the rest of Europe, economic growth in Portugal slowed significantly from 5.7% in 1977 to an estimated 2% in 1980. Inflation decreased from 20% in 1979 to 18% in 1980 and unemployment was close to 9%. The extractive sector of the mineral industry accounted for about 1% of the gross domestic product of $20 billion.[2] The mineral industry of Portugal was modest by world standards, except for the production of tungsten which contributed about 4% to the world total in 1980. Output of other minerals was of domestic significance only, and production of stone was the most important.

After many years of political instability, elections held in October 1980 increased the majority of the governing coalition. The new Government planned to revise the Constitution and take Portugal into the European Communities.

During 1980, the major events of the country's mineral industry were the preparation for production from the mixed sulfate ore deposit at Castro Verde, the beginning of modernization at the Seixal steel plant, and the modernization of a coal mine in northern Portugal.

PRODUCTION

Latest trends in minerals production of Portugal are shown in table 1.

Table 1.—Portugal: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Arsenic, white	278	222	253	r e345	200
Beryl concentrate, gross weight	--	--	(2)	5	319
Columbite and tantalite concentrates, gross weight	5	3	8	4	34
Copper:					
Mine output, metal content	4,560	3,216	3,617	3,600	35,200
Metal:					
Smelter, primary and secondary[e]	2,800	3,300	r3,000	r5,500	36,600
Refined, primary	2,754	3,392	2,997	3,373	34,600
Gold, mine output, metal content—troy ounces	10,031	r8,841	9,131	e12,400	7,600
Iron and steel:					
Iron ore and concentrate:					
Gross weight:					
Hematite and magnetite	31,434	22,384	19,761	22,119	314,773
Manganiferous	17,870	30,250	34,760	37,440	341,850
Total	49,304	52,634	54,521	59,559	356,623
Iron content:					
Hematite and magnetite	21,022	15,078	13,437	15,040	10,046
Manganiferous	7,237	11,767	12,757	13,740	15,359
Total	28,259	26,845	26,194	28,780	25,405

See footnotes at end of table.

Table 1.—Portugal: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Iron and steel —Continued					
Metal:					
Pig iron thousand tons	344	357	353	366	300
Ferroalloys:					
Ferromanganese[e]	55,000	55,000	78,000	75,000	74,000
Silicomanganese[e]	2,000	5,000	15,000	15,000	17,000
Ferrosilicon[e]	r23,000	r24,000	r30,000	r25,000	25,000
Silicon metal[e]	--	13,200	r20,000	32,000	33,000
Ferrotungsten	284	166	163	e200	200
Other[e]	(4)	(4)	(4)	(4)	--
Total[e]	r80,284	r97,366	143,163	147,200	149,200
Crude steel thousand tons	463	537	577	649	653
Semimanufactures do	436	561	643	640	650
Lead:					
Primary	496	123	118	--	--
Refined, secondary	r600	r400	286	31	3 1,000
Silver, mine output, metal content troy ounces	28,325	25,753	22,602	e30,700	18,800
Tin:					
Mine output, metal content	332	267	282	225	3 274
Metal, primary and secondary	319	r1,016	854	1,121	3 938
Titanium: Ilmenite concentrate, gross weight	367	229	325	268	3 234
Tungsten, mine output, metal content	r1,259	r1,005	1,104	1,377	3 1,467
Uranium concentrate: U content	101	111	102	134	3 95
Zinc: Smelter, primary	--	--	--	--	2,000
NONMETALS					
Barite	90	590	620	704	1,300
Cement, hydraulic thousand tons	3,713	4,296	5,120	5,138	3 5,748
Clays:					
Kaolin	63,895	72,860	73,555	e54,000	3 49,274
Refractory	85,070	105,686	181,717	e100,000	100,000
Diatomite	3,150	3,390	2,700	3,400	3 2,310
Feldspar	13,323	15,246	21,582	33,808	3 40,802
Gypsum and anhydrite	159,594	175,961	208,701	r e200,000	205,000
Lime, hydrated and quicklime thousand tons	222	227	260	261	270
Lithium minerals: Lepidolite	1,200	1,200	1,200	1,000	3 1,000
Nitrogen: N content of ammonia thousand tons	159	185	252	222	3 200
Pigments, mineral, natural: Iron oxides	40	62	e65	e60	65
Pyrite and pyrrhotite (including cuprous), gross weight thousand tons	416	360	314	349	350
Salt:					
Rock do	306	351	326	408	401
Marine do	163	r148	150	e140	130
Total do	469	r499	476	548	531
Sand and gravel:					
Sand do	5,138	6,882	5,294	NA	NA
Gravel do	325	153	464	NA	NA
Sodium compounds, n.e.s.:					
Sodium carbonate	114,137	129,724	131,452	182,770	175,000
Sodium sulfate	48,894	46,479	51,344	44,831	52,200
Stone:					
Basalt thousand tons	78	121	71	NA	NA
Calcareous:					
Dolomite do	75	93	93	NA	NA
Limestone, marl, calcite do	6,556	7,390	8,932	NA	NA
Marble do	253	267	303	NA	NA
Diorite do	12,651	4,222	620	NA	NA
Gabbro do	8	10	--	NA	NA
Granite do	3,243	3,625	6,796	NA	NA
Graywacke do	20	20	38	NA	NA
Ophite do	51	74	65	NA	NA
Porphyry do	104	85	--	NA	NA
Quartz do	102	116	122	125	125
Quartzite do	279	299	316	NA	NA
Schist do	134	125	275	NA	NA
Serpentine do	1	1	--	NA	NA
Slate do	38	50	59	NA	NA
Syenite do	6	9	9	NA	NA
Sulfur:					
Content of pyrite do	181	156	136	151	155
Byproduct, all sources do	1	2	1	1	2
Total do	182	158	137	152	157

See footnotes at end of table.

Table 1.—Portugal: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Talc	[r]1,505	1,610	1,709	2,727	2,598
MINERAL FUELS AND RELATED MATERIALS					
Coal, anthracite thousand tons	193	195	180	179	[3]177
Coke, metallurgical do	199	206	203	179	140
Fuel briquets, all grades	512	381	290	247	200
Gas, manufactured million cubic feet	4,691	4,819	4,965	4,900	5,000
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	6,521	5,983	6,589	8,700	7,140
Jet fuel do	2,945	3,076	2,827	3,696	3,000
Kerosine do	565	464	640	947	900
Distillate fuel oil do	9,287	9,296	9,647	22,402	18,500
Residual fuel oil do	15,416	17,100	16,826	25,669	32,581
Lubricants do	518	677	469	449	500
Other:					
Liquefied petroleum gas do	1,472	1,662	1,495	2,045	2,000
Asphalt do	205	315	348	547	2,000
Unspecified do	2,558	2,559	1,664	3,600	4,000
Refinery fuel and losses do	3,434	3,577	4,004	[e]5,100	5,000
Total do	42,921	44,709	44,509	73,155	75,621

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Aug. 4, 1981.
[2]Less than 1/2 unit.
[3]Reported figure.
[4]Revised to zero.

TRADE

Trade in Portugal's minerals for 1978 and 1979 are shown in tables 2 and 3.

Table 2.—Portugal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	2,921	9,812	--	Spain 3,701; France 1,536; India 513.
Chromium oxides kilograms	800	700	--	All to Angola.
Cobalt oxide and hydroxides	9	--		
Columbium and tantalum: Tantalum ore and concentrate	9	--		
Copper:				
Ore and concentrate	100	1,004	--	Sweden 1,000.
Sulfate value	--	$41	--	All to São Tomé and Principe.
Metal including alloys, all forms	1,711	5,046	626	France 1,769; Italy 1,077; Belgium-Luxembourg 549.
Iron and steel:				
Roasted pyrite	14,689	27,514	--	West Germany 27,120; Spain 385.
Metal:				
Scrap	9,716	4,796	(1)	Netherlands 2,554; Spain 2,016.
Pig iron, ferroalloys, similar materials	103,716	92,773	37,634	Italy 11,105; Canada 8,905; Romania 8,000.
Semimanufactures:				
Bars, rods, angles, shapes, sections	3,797	69,387	--	Syria 33,516; Egypt 12,608; Switzerland 10,462.
Universals, plates, sheets	10,690	35,833	--	Romania 12,125; Switzerland 10,673; Egypt 5,454.
Hoop and strip	312	1,018	--	Angola 693; Morocco 290.
Rails and accessories	264	320	--	Pakistan 262.
Wire	172	155	NA	NA.
Tubes, pipes, fittings	5,215	5,408	--	Spain 1,172; Italy 776; France 523; Angola 492.
Castings and forgings, rough	7,105	12,562	3,851	United Kingdom 4,478; Sweden 1,183; France 981.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	740	1,635	--	Mainly to Belgium-Luxembourg.
Oxides	5	113	--	Belgium-Luxembourg 100.
Metal including alloys, all forms	621	100	--	Angola 86.
Magnesium metal including alloys, waste and scrap	--	8	--	All to West Germany.
Manganese:				
Ore and concentrate	4,000	2,050	1,400	France 650.
Oxides	70	(1)	--	All to Guinea-Bissau.
Molybdenum metal including alloys, all forms, value	--	$470	$470	
Nickel metal including alloys, all forms	69	84	--	Netherlands 34; United Kingdom 34; India 14.
Platinum-group metals including alloys, unwrought and partly wrought, troy ounces	r1,736	3,312	--	France 1,704; United Kingdom 1,061.
Silver metal including alloys, unwrought and partly wrought, do.	354	488,878	--	West Germany 379,387; France 109,345.
Tin metal including alloys, all forms	5	9	--	Angola 5; United Kingdom 3.
Tungsten:				
Ore and concentrate	1,617	1,704	216	United Kingdom 700; West Germany 219; Netherlands 202.
Metal including alloys, all forms, kilograms	100	--		
Zinc:				
Oxides	3,270	2,087	--	West Germany 1,601; Netherlands 311.
Metal including alloys, all forms	133	129	--	Netherlands 100.
Other:				
Ores and concentrates	463	315	--	Belgium-Luxembourg 200; West Germany 104.
Ash and residue containing nonferrous metals	r46,708	11,339	--	West Germany 10,226.
Oxides, hydroxides, peroxides	10	4	--	United Kingdom 2; Spain 2.
Metals:				
Metalloids	18,530	21,066	--	Japan 9,600; West Germany 6,151; Romania 2,200.
Precious metals including alloys, waste and sweepings, value	$288,780	$319,802	--	Belgium-Luxembourg $131,633; United Kingdom $126,175; France $44,702.
Base metals including alloys, all forms	1,336	6	--	Mainly to Angola.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	70,239	85,646	--	United Kingdom 80,207.
Artificial corundum	--	6	--	Spain 4.
Grinding and polishing wheels and stones	57	69	21	West Germany 20; Angola 11.
Asbestos	118	--		
Barite and witherite	3	283	--	Mainly to Tunisia.
Boron materials: Boric acid	--	2	--	Mainly to Mozambique.
Cement	5,174	13,288	(1)	Cape Verde 4,978; Gibraltar 4,272; Guinea-Bissau 3,955.
Chalk	91	22	--	Cape Verde 17.
Clays and clay products:				
Crude clays:				
Kaolin	36	--		
Other	2,007	906	--	Spain 568; Mozambique 259.
Products:				
Refractory including nonclay brick	664	429	NA	Angola 264; France 81.
Nonrefractory	8,467	16,873	369	Spain 2,848; France 2,539; United Kingdom 2,108; West Germany 1,805.
Diamond:				
Gem, not set or strung, thousand carats	58	6,081	--	All to Switzerland.
Industrial, do.	--	29,602	--	Switzerland 29,596.
Diatomite and other infusorial earth	1,213	16	--	Venezuela 10; Guinea-Bissau 6.
Feldspar, leucite, nepheline, etc	2,148	9,099	--	France 4,900; East Germany 3,520; United Kingdom 675.
Fertilizer materials:				
Natural and manufactured:				
Nitrogenous	148,833	181,894	--	Netherlands 40,940; West Germany 36,907; Belgium-Luxembourg 23,002.
Phosphatic	71,840	108,968	--	Brazil 65,814; United Kingdom 13,563; U.S.S.R. 9,960.
Potassic	1,315	100	--	All to Cyprus.
Other including mixed	61,365	89,220	--	Belgium-Luxembourg 58,750; Nigeria 9,960; Netherlands 6,200.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Ammonia	14,091	8,648	--	Greece 8,644.
Graphite, natural	90	106	--	Spain 104.
Gypsum and plasters	64	145	--	Mozambique 75; Angola 52.
Lime	389	66	--	Cape Verde 39; Angola 27.
Mica, all forms	414	232	--	Mainly to United Kingdom.
Pigments, mineral:				
Natural, crude	r69	23	--	São Tomé and Principe 7; Mozambique 5.
Iron oxides, processed	51	21	--	Angola 8; Cape Verde 6.
Pyrite, gross weight	135	133	--	Sweden 122.
Salt	4,083	15,024	--	United Kingdom 13,891.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	70	105	--	São Tomé and Principe 80; Guinea-Bissau 11.
Caustic potash kilograms	100	300	--	All to Cape Verde.
Soda ash	295	4,837	--	Argentina 3,000; Spain 1,790.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Marble and other calcareous	111,246	108,444	42	Italy 37,399; Spain 29,011; Belgium-Luxembourg 12,345.
Slate	8,037	3,634	36	Denmark 1,348; West Germany 1,194; Netherlands 662.
Granite and other	21,311	23,660	242	Japan 16,740; Italy 6,440.
Worked:				
Slate	6,745	8,690	38	West Germany 2,940; Belgium-Luxembourg 2,433; Netherlands 2,147.
Paving and flagstone	102,868	138,230	80	West Germany 92,074; Denmark 15,582; United Kingdom 9,087.
Marble and other	40,978	46,593	1,730	West Germany 18,652; France 7,339; United Kingdom 5,972.
Dolomite, chiefly refractory grade	--	3	--	All to Angola.
Gravel and crushed rock	600	4,660	(1)	Gibraltar 4,450.
Limestone, except dimension	233	215	--	Mozambique 68; Guinea-Bissau 63.
Quartz and quartzite	7,938	3,812	--	Norway 2,000; United Kingdom 788; West Germany 703.
Sand excluding metal-bearing	13,862	14,112	--	Gibraltar 12,200.
Sulfur:				
Elemental, all forms	92	205	--	Cyprus 199.
Sulfuric acid	335	28,649	6,204	Spain 8,934; Italy 7,325; Canada 5,996.
Talc, steatite, soapstone, pyrophyllite	127	18	--	Angola 10; Mozambique 7.
Other:				
Crude	r139	111	--	Spain 110.
Slag, dross, similar waste, not metal-bearing:				
From iron and steel manufacture	2,140	1,226	--	France 1,200.
Other kilograms	--	200	--	All to United Kingdom.
Oxides, hydroxides of magnesium, strontium, barium value	--	$20	--	All to Cape Verde.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	1,765	1,742	--	Guinea-Bissau 833; Cape Verde 777.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural kilograms	9,100	300	300	
Carbon black do	3,200	300	--	Mozambique 200; Angola 100.
Coal, all grades including briquets	18	11	--	France 10; Cape Verde 1.
Coke and semicoke	24	15	--	Cape Verde 8; West Germany 5.
Hydrogen and rare gases	20	(1)	--	All to Cape Verde.
Petroleum refinery products:				
Bunker deliveries:				
Gasoline, aviation thousand 42-gallon barrels	(1)	(1)		
Kerosine do	(1)	(1)		NA.
Jet fuel do	1,217	1,121		NA.
Distillate fuel oil do	8	27		NA.
Residual fuel oil do	1,171	1,136		NA.
Lubricants do	65	142		NA.
Unspecified do	234	405		NA.
Nonbunker deliveries:				
Gasoline, motor do	78	768	207	Netherlands 320; United Kingdom 161.
Kerosine do	22	(1)	--	All to Republic of South Africa.
Jet fuel do	--	167	(1)	Iraq 103; Spain 64.
Residual fuel oil do	--	510	360	United Kingdom 150.
Lubricants do	54	36	(1)	Spain 11; United Kingdom 7.

See footnotes at end of table.

Table 2.—Portugal: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products —Continued				
Nonbunker deliveries —Continued				
Liquefied petroleum gas thousand 42-gallon barrels	6	11	--	Cape Verde 10.
Mineral jelly and wax do	1	15	--	Netherlands 7; West Germany 7.
Unspecified do	118	1,599	1	Netherlands 746; Italy 204; Sweden 191; United Kingdom 177.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	15	31	--	Zaire 20.

r Revised. NA Not available.
[1]Less than 1/2 unit.

Table 3.—Portugal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	2,191	550	--	Spain 308; Suriname 140; Denmark 102.
Oxides and hydroxides	6,808	6,285	62	West Germany 2,630; United Kingdom 2,098; France 1,234.
Scrap	91	503	1	Norway 393; Denmark 40.
Unwrought	20,222	21,803	200	Canada 7,951; France 4,199; Spain 4,160.
Semimanufactures	15,855	14,177	286	Belgium-Luxembourg 3,217; Spain 2,002; Austria 1,998.
Arsenic	8	--		
Beryllium: Beryl ore and concentrate	10,788	762	8	Spain 576; Netherlands 60.
Chromium:				
Chromite	692	733	--	Republic of South Africa 294; Netherlands 180; Finland 131.
Oxides and hydroxides	237	254	--	West Germany 227.
Cobalt oxides and hydroxides	6	9	1	Belgium-Luxembourg 6.
Columbium and tantalum: Columbium ore and concentrate	14,999	NA	NA	NA.
Copper:				
Ore and concentrate	6,248	62	--	Spain 44; United Kingdom 18.
Oxides	246	296	(1)	United Kingdom 142; Norway 104; West Germany 31.
Sulfate solution	(1)	10	--	Mainly from United Kingdom.
Metal including alloys:				
Scrap	826	269	24	United Kingdom 100.
Unwrought:				
Blister	985	643	--	All from Chile.
Refined, unalloyed	13,525	10,933	--	Belgium-Luxembourg 2,900; France 2,475; Zambia 1,302; Canada 1,156.
Other	2,538	1,345	(1)	United Kingdom 642; Spain 628.
Semimanufactures	10,427	12,556	28	United Kingdom 3,715; France 2,224; Italy 1,911; Spain 1,503.
Gold:				
Ore and concentrate value	--	$143	--	All from France.
Metal including alloys, unworked or partly worked troy ounces	6,230	8,982	81	Belgium-Luxembourg 6,653; Switzerland 1,903.
Iron and steel:				
Ore and concentrate including sinters, pellets, briquets, etc	386,182	619,650	--	Brazil 143,915; Venezuela 129,926; Mauritania 128,590.
Roasted pyrites	NA	37	--	Netherlands 20; Australia 17.
Metal:				
Scrap	663,603	145,809	75,392	Netherlands 30,633; U.S.S.R. 14,931; United Kingdom 8,440.
Pig iron, ferroalloys, similar materials	37,127	58,204	(1)	Spain 48,180; Canada 4,034; Republic of South Africa 3,179.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Steel, primary forms	232,305	147,824	--	Japan 59,333; West Germany 37,941; Netherlands 16,916.
Semimanufactures:				
Bars, rods, angles, shapes, sections	139,032	105,048	52	West Germany 27,459; Spain 18,810; Belgium-Luxembourg 13,500.
Universals, plates, sheets	223,923	178,020	772	West Germany 54,821; Czechoslovakia 20,272; Belgium-Luxembourg 19,982.
Hoop and strip	73,229	65,225	72	West Germany 28,522; Belgium-Luxembourg 23,345; France 8,795.
Rails and accessories	13,107	3,847	--	West Germany 1,288; United Kingdom 1,227; Austria 886.
Wire	27,830	17,184	35	Spain 3,860; United Kingdom 2,619; Republic of South Africa 2,392.
Tubes, pipes, fittings	37,276	26,077	--	West Germany 11,066; France 5,361; United Kingdom 3,359.
Castings and forgings, rough	35,091	728	62	France 218; West Germany 124.
Total	549,488	396,129		
Lead:				
Oxides	114	60	--	West Germany 40; Spain 20.
Metal including alloys:				
Scrap	82	91	14	United Kingdom 77.
Unwrought	16,622	28,044	NA	United Kingdom 12,143; Switzerland 1,001.
Semimanufactures	49	5	(1)	Spain 2.
Magnesium metal including alloys, all forms	8	33	25	France 2; Norway 2.
Manganese:				
Ore and concentrate	144,616	235,709	--	Gabon 109,700; Republic of South Africa 53,019; Brazil 44,620.
Metal including alloys, all forms	1,001	846	NA	Belgium-Luxembourg 241; Ireland 221; Spain 138.
Mercury 76-pound flasks	1,007	815	(1)	Spain 705.
Molybdenum metal including alloys, all forms kilograms	4,400	2,000	(1)	France 1,000.
Nickel:				
Matte and speiss	118	104	(1)	Canada 70; Norway 20; Finland 8.
Metal including alloys:				
Scrap	11	18	NA	NA.
Unwrought	233	206	--	Canada 71; West Germany 48; Finland 44.
Semimanufactures	468	452	2	West Germany 142; Finland 66.
Platinum-group metals including alloys, unworked or partly worked troy ounces	5,985	8,753	10	France 3,646; Switzerland 2,211; United Kingdom 2,095.
Rare-earth metals, oxides	18	18	--	France 12; United Kingdom 4.
Silver metal including alloys, unworked or partly worked thousand troy ounces	r1,253	1,422	--	West Germany 1,200; France 90.
Tantalum metal including alloys, all forms value	$319	$818	--	All from Austria.
Tin:				
Ore and concentrate	332	256	--	Indonesia 206; Malaysia 50.
Oxides	r81	61	36	West Germany 18; United Kingdom 7.
Metal including alloys:				
Scrap	10	20	18	Sweden 1.
Unwrought	464	529	--	Thailand 200; Malaysia 140; Spain 60.
Semimanufactures	39	52	(1)	Netherlands 24; United Kingdom 20.
Titanium:				
Ore and concentrate: Rutile	476	NA	NA	NA.
Oxides	7,794	8,231	2	Spain 2,157; Finland 1,373; West Germany 1,317.
Tungsten:				
Ore concentrate including residues	--	100	--	All from Spain.
Metal including alloys, all forms kilograms	400	600	100	Netherlands 200; United Kingdom 100.
Zinc:				
Ore and concentrate	22	22	--	All from Spain.
Oxides	100	166	--	West Germany 65; Netherlands 47; United Kingdom 38.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Metal including alloys:				
Scrap	98	781	39	Spain 306; Canada 145; United Kingdom 118.
Blue powder	545	815	--	United Kingdom 376; Norway 306; Belgium-Luxembourg 76.
Unwrought	17,139	14,524	18	Canada 3,242; Spain 3,169; France 2,990; Belgium-Luxembourg 2,139.
Semimanufactures	1,228	2,094	21	West Germany 1,159; Belgium-Luxembourg 633; United Kingdom 212.
Other:				
Ores and concentrates:				
Of titanium, vanadium, zirconium	886	1,126	--	Spain 637; Australia 190; Republic of South Africa 176.
Of base metals, n.e.s	20	386	--	Spain 335.
Ash and slag containing nonferrous metals	174	95	--	Chile 70; India 25.
Oxides, hydroxides, peroxides	r1,611	1,703	42	United Kingdom 967; Spain 424; West Germany 141.
Metals:				
Metalloids	44	258	1	Spain 254.
Alkali, alkaline earth, rare-earth metals kilograms	600	3,700	--	United Kingdom 3,400.
Pyrophoric alloys	r39	45	--	Netherlands 18; United Kingdom 12; France 6.
Base metals including alloys, all forms	147	115	(1)	Belgium-Luxembourg 59; Spain 16.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	372	300	6	Netherlands 123; Italy 74.
Dust and powder of precious and semiprecious stones, including diamond kilograms	286	51	--	United Kingdom 34; Ireland 13.
Artificial corundum	1,384	1,753	4	West Germany 867; Brazil 343; France 268.
Grinding and polishing wheels and stones	563	530	6	Italy 205; United Kingdom 84; Spain 58; Austria 55.
Asbestos	17,111	11,213	16	Republic of South Africa 6,350; Canada 3,889; Australia 431.
Barite and witherite	458	645	--	West Germany 234; France 206; Spain 145.
Boron materials:				
Crude natural borates	2,450	4,570	--	Turkey 3,700; Netherlands 467.
Oxide and acid	451	553	--	France 364; U.S.S.R. 126; Turkey 33.
Borates and perborates	3,517	3,924	1,906	France 992; Netherlands 926.
Cement	64,281	95,800	36	Spain 83,814; United Kingdom 11,645.
Chalk	7,805	10,319	--	Spain 4,770; France 3,390; Belgium-Luxembourg 1,009.
Clays and clay products:				
Crude clays:				
Bentonite	22,991	22,477	229	Spain 21,050.
Kaolin	10,354	12,413	373	United Kingdom 9,916; France 1,240.
Other	10,450	8,038	80	Spain 4,480; France 1,953; United Kingdom 1,155.
Products:				
Refractory including nonclay brick	10,872	10,282	16	West Germany 3,918; Austria 2,083; France 1,279.
Nonrefractory	402	482	--	Spain 272; Italy 182.
Cryolite and chiolite	94	55	--	All from Denmark.
Diamond, except powder and dust:				
Gem, not set or strung thousand carats	90	13	1	Belgium-Luxembourg 7; West Germany 5.
Industrial do	1	2	NA	NA.
Unclassified do	--	125	(1)	Switzerland 95; United Kingdom 22.
Diatomite and other infusorial earth	3,534	4,058	797	Spain 2,855; West Germany 200.
Feldspar, leucite, nepheline, etc	2,691	2,209	--	France 1,586; United Kingdom 351.
Fertilizer materials:				
Crude:				
Nitrogenous	1,500	1,197	--	All from Chile.
Phosphatic	389,748	389,794	3,653	Morocco 379,730.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Manufactured:				
Nitrogenous	17,071	31,097	1	East Germany 12,447; West Germany 10,497.
Phosphatic	1,256	1,242	--	All from France.
Potassic	72,983	90,984	NA	Spain 72,155; East Germany 10,672.
Other including mixed	701	11,584	8,588	Spain 1,826.
Ammonia	23,809	6,023	(1)	Libya 6,018.
Graphite:				
Natural	294	184	--	United Kingdom 80; Norway 44.
Artificial	760	772	--	West Germany 444; Spain 299; United Kingdom 28.
Gypsum and plasters	31,771	35,502	2	Spain 23,021; Morocco 12,341.
Iodine	3	11	--	Japan 9.
Lime, hydraulic	3	530	--	Spain 528.
Magnesite	2,476	3,096	12	United Kingdom 2,137; Netherlands 274.
Mica:				
Crude including splittings and waste	399	469	NA	Norway 351; United Kingdom 48.
Worked including agglomerated splittings	24	27	2	Switzerland 10; Belgium-Luxembourg 6.
Pigments, mineral:				
Natural, crude	28	91	--	Spain 71; France 16.
Iron oxides, processed	2,286	1,976	(1)	West Germany 1,520; Spain 300.
Precious and semiprecious stones other than diamond, natural and synthetic kilograms	81	71	(1)	Austria 19; West Germany 17; Switzerland 17; France 14.
Pyrite, unroasted	6	6	--	Mainly from West Germany.
Salt and brine	92,812	48,800	--	Italy 26,136; Spain 19,998.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	13,998	17,511	(1)	Spain 11,966; Belgium-Luxembourg 4,465.
Caustic potash	367	382	--	Italy 229; France 89.
Soda ash	6,417	1,518	--	France 1,500; United Kingdom 11.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	25	1	--	All from West Germany.
Worked	40	113	--	Spain 64; Italy 39.
Dolomite, chiefly refractory grade	5,410	6,527	--	Spain 1,861; Italy 1,855; France 1,836.
Limestone flux and calcareous stone	1,500	2,402	--	Mainly from France.
Gravel and crushed rock	69	67	2	France 27; Belgium-Luxembourg 23.
Quartz and quartzite	210	160	NA	Sweden 97; Belgium-Luxembourg 46.
Sand, other than metal-bearing	8,225	7,985	33	Spain 6,005; Belgium-Luxembourg 1,620.
Sulfur:				
Elemental:				
Other than colloidal	43,524	90,443	--	France 67,414; Poland 23,029.
Colloidal	1	1	--	Mainly from West Germany.
Sulfuric acid	161,765	40,336	NA	Norway 16,890; West Germany 12,160; United Kingdom 11,274.
Talc, steatite, soapstone, pyrophyllite	4,144	3,336	80	France 2,051; Austria 490.
Other:				
Crude:				
Meerschaum, amber, jet	3	NA	NA	NA.
Other	498	318	--	Republic of South Africa 98; Spain 98; France 97.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	25,420	29,407	--	France 28,966; United Kingdom 404.
Other slag and ash	--	2	--	All from West Germany.
Oxides and hydroxides of magnesium, strontium, barium	69	22	1	France 20.
Bromine and other halogens excluding iodine	44	2	NA	Mainly from West Germany.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	463	245	1	France 151; Belgium-Luxembourg 49.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,772	1,649	68	West Germany 1,502.
Carbon black	10,028	10,162	197	France 5,274; Spain 3,247; West Germany 766.

See footnotes at end of table.

Table 3.—Portugal: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal, all grades including briquets	435,253	376,858	252,957	Poland 109,424.
Coke and semicoke	107,615	98,907	(1)	Netherlands 36,270; United Kingdom 25,489; West Germany 18,441.
Hydrogen and rare gases[2]	1	46	2	Spain 28; France 15.
Peat including briquets and litter	554	908	--	West Germany 194; Sweden 182; Finland 123; Netherlands 106.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	47,572	56,925	--	Iraq 24,033; Saudi Arabia 16,055; Iran 7,250; U.S.S.R. 5,828.
Refinery products:				
Gasoline:				
Aviation do	4	10	6	United Kingdom 3.
Motor do	91	32	--	France 24; Italy 4.
Jet fuel do	r186	318	56	Netherlands Antilles 50; Venezuela 44; Libya 39; Spain 39.
Kerosine do	r4	5	(1)	Netherlands 4.
Distillate fuel oil do	1,453	1,408	60	France 521; Romania 222; Netherlands 178; Spain 115.
Residual fuel oil do	1,236	1,657	--	Netherlands 493; France 309; Venezuela 248; Netherlands Antilles 237.
Lubricants do	212	207	6	France 98; United Kingdom 36; Italy 33.
Other:				
Liquefied petroleum gas do	4,068	3,927	19	United Kingdom 1,828; France 718; Italy 608.
Mineral jelly and wax do	15	15	(1)	United Kingdom 6; West Germany 4; France 2.
White spirit do	6	2	--	Belgium-Luxembourg 1.
Petroleum coke do	70	12	11	Netherlands 1.
Bitumen and other residues do	429	243	(1)	Spain 179; Netherlands Antilles 42.
Bituminous mixtures, n.e.s. do	39	56	(1)	Spain 43; United Kingdom 8.
Unspecified do	r93	75	2	Belgium-Luxembourg 26; Netherlands 16; France 13; Italy 11.
Total do	r7,906	7,967		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11,802	15,829	4	Spain 3,360; Italy 2,690; France 1,716; Netherlands 1,666.

rRevised. NA Not available.
1Less than 1/2 unit.
2Excludes quantity valued at $4,961 in 1978 and $319,496 in 1979.

COMMODITY REVIEW

METALS

Copper.—Exploration continued on a deposit of complex copper-lead-zinc ore near Castro Verde in southern Portugal. The mineralized area contains several ore bodies, of which Neves and Corvo were the most significant.

According to preliminary reports, the Corvo deposit contained 20 million tons of high-grade ore (5% to 6% copper), and the Neves deposit contained about 40 to 50 million tons of ore, with a copper content of between 1% and 1.5%. Chemical analysis of Neves-Corvo ores showed the following composition: Sulfur, 4%; iron, 4%; zinc, 2% to 4.5%; copper, 1% to 6%; arsenic, 0.5%; silver, 45 grams per ton; and gold, 0.3 grams per ton.

During 1980, the Government of Portugal requested French shareholders to transfer 11% of their shares to Portuguese interests to give Portugal majority ownership in the company at Neves-Corvo. A new firm Sociedade Mineira Neves Corvo S.A.R.L., in which a Portuguese Government-owned company holds 51% of the capital, was created to implement the agreement and develop and operate the future mine. The rest is equally divided between the private company Peñarroya (French) and the French Government-owned Bureau de Recherches Géologiques et Minières. Reportedly, mining should start sometime after the beginning of 1983.

Iron and Steel.—Exploration and preliminary development work continued on the Moncorvo iron deposit, located east of Torre

Moncorvo in northeast Portugal. The ore reserves at Moncorvo were reported at 500 million tons, with an average content of 37% iron and 0.58% phosphorus.

During 1980, plans for expanding the Seixal steelworks started to be implemented. The Siderurgia Nacional S.A.R.L. negotiated purchase of continuous caster from an unnamed firm from the Federal Republic of Germany. Vöest-Alpine of Austria received the order for supplying two 120-ton Linz-Donawitz (LD) converters. The Seixal works expansion was planned to increase capacity by 1 million tons of steel and 800,000 tons of rolled products. In addition to two LD converters, the Seixal plant will include one 1.5-million-ton-per-year pelletizing plant, one 1-million-ton-per-year blast furnace (9 meters in diameter), three 6-strand continuous casters, one 400,000-ton wire rod mill, and one 400,000-ton-per-year light section mill.

Pyrite.—After the Council of Ministers authorized implementation of a plan for the total utilization of pyrite in 1979, preparatory works for expansion started in the Aljustrel Mine during 1980. Plans call for production of 1.2 million tons of pyrite annually by 1982 and 2.7 million tons by 1985. The average grade of Aljustrel ore was reported as follows: Zinc, 2.2% to 3%; lead, 0.9% to 1.2%; sulfur, 41% to 46%; and iron, 36%. Recovery of nonferrous metals, pelletization of iron cinder and its use in steel plants were part of the plan. Outokumpu Oy of Finland, and the Swedish Government through LKAB International AB, were the principal contractors for the project.

Tungsten.—During 1980, Sociedade Portuguesa de Empreendimentos acquired a controlling interest in the Vale de Gatos (Vila Real) tungsten mine. After several years of exploration, Union Carbide relinquished its tungsten interests in the Covas area. Reportedly, the small tungsten deposits discovered will be operated by local companies.

Modernization and modification of the mill at Borralha, operated by Mines de Borralha S.A.R.L., started during 1980. Details of the program were not made public.

Joint exploration by Geomines of Belgium and local companies continued for tungsten deposits at Tabução. During 1980, the largest producer of tungsten was the mine of Panasqueira, operated by Beralt Tin & Wolfram (Portugal) S.A.R.L., a subsidiary of Beralt Tin & Wolfram, Ltd., of the United Kingdom. Tungsten remained the only mineral produced in Portugal which had significance for the world mineral economy.

Zinc.—According to reports, an 11,000-ton-per-year zinc electrolytic plant started production at a site near the town of Barreiro, southeast of Lisbon in the second half of 1980. The owner and the operator of the new plant was the Goverment-owned concern Quimigal E.P.

NONMETALS

Beryl.—Commercial deposits of beryl are found in the pegmatites of northern Portugal, in Braga and Vila Real Districts. Beryl was produced as a byproduct of quartz-feldspar output. Of quartz-feldspar producers in operation in Portugal, the largest producers of beryl were Companhia Portuguesa de Fornos Electricos S.A.R.L. (F. Electricos) and Sociedade de Exploração de Rochas Lda. (Quarfel) a wholly owned subsidiary of Metalurgica do Norte S.A.R.L. (Milnorte), an important producer of silicon metal in Portugal.

Diatomite.—The largest producer of diatomite, with about 90% of country's output, was Sociedade Anglo Portuguesa de Diatomite Lda., which operated two mines near Couto Mineiro do Jordim in the southern part of the Leiria District. In addition, a second producer, Sociedade Quisselgur Lda., operated a small mine at Amieira in the region of Obidos, east of Caldas de Rainha, Leiria District.

Feldspar-Quartz.—Quartz production was associated with feldspar in Portugal. During 1980, the averge number of companies that produced both quartz and feldspar was 13; 8 reported production of quartz alone, and 3 registered output of feldspar only. As in the past, during 1980 producers of silicon and ferrosilicon owned and operated their own sources of quartz. Fornos Electricos owned and operated mines at Senhora da Assunção Varzea e Valdeireiras, near Satão, and at Santa Luzia near Viseu, both in Viseu District. The mined ore was processed in a washing plant at Canas do Senhorim, also in Viseu District. Average yearly output from Fornos Electricos' quartz mines was about 50,000 tons of quartz and about 1,000 tons of feldspar. Quartz was used in the metallurgical facilities of Fornos Electricos, and feldspar was sold to the domestic ceramic industry. Milnorte obtained quartz supply from its mining subsidiary Quarfel. Principal mines

were at Mata da Lapeira, near Celorico de Basto in Braga District; Corga do Cavacao in Guarda District; and Medronheiro, near Satão, in Viseu District. Quarfel produces about 20,000 tons of quartz per year.

The most important producer of quartz-feldspar in Portugal during 1980 was Unimil Minerais Lda., which operated the Arreigada and Vilela Mines in the Pôrto District and the Celorico de Basta Mine in Braga District. The ore is processed in a grinding plant at Formiga, approximately 20 kilometers from the Arreigada Mine. A new mill was under construction at Seixoso near Amarante. The project was financed jointly by Unimil and Minas do Zezere S.A.R.L. In addition to ore, tailings from tin operations of Zezere will be processed in the new mill.

The A. J. da Fonseca was the largest feldspar producer in Portugal during 1980. In addition, the company produced some quartz. Most of the operations of Fonseca were in the Braga District, at Viana do Castelo and in the Vila Real District. About 75% of the company's feldspar output came from ore operations near Chaves. Fonseca produced about 10,000 tons in 1978, the latest year for which data were reported. In addition to Unimil, Fonseca, Quarfel, and Fornos Electricos, there were a number of other feldspar-quartz producing companies operating in Portugal. The more important of these were: Minas do Baranco Lda., at Gouveia, Guarda District; Graliminas-Mineiro da Gralheira Lda., at Villa Longa, Viseu District; and Joao Cergueira Antones, with a number of mines at Ponte de Barea, Viana do Castelo, and Montealegre, Vila Real District.

Lithium.—During 1980, lepidolite was produced in one mine near Seixo Amarelo in the Guarda District. The operator was Sociedade Mineira Carolinos Lda. The average content of lithium oxide (Li_2O) in ore was reported at 1.5%. A deposit of lithium minerals at Goncalo, Guarda District, owned by Societa Mineira Pegmatites (Pegmatica), was not in operation.

Salt.—Salt solution mining by Segema-Sociedade Mineira Lda. at Torres Vedras, north of Lisbon, remained the largest source of salt in Portugal and accounted for about two-thirds of the country's output. A 25-kilometer-long pipeline brings the solution to the soda ash plant of Soda Povoa at Povoa de Santa Ira. Soda Povoa was a subsidiary of Solvay et Cie. of Belgium. Mineira de Sais Alcalinos S.A.R.L. (Clona) was also a salt producer in 1980, from a rock salt deposit near Loulé in the Algarve District, in southern Portugal.

Silica Sand.—Silica sand for use in glass, foundry, and ceramics was produced from two regions, Figuera da Foz in the Coimbra District and Rio Maior in the Santarem District. Sarel-Sociedade de Arieas Reunidas Lda, the largest producer, had active operations in both areas. In the Maioz area of the Santarém District, silica sand was produced by the smaller producers Maoril-Aries Industriais, Lda., and Sifucel-Silicas Lda.

Stone.—Production of stone was the most important segment of the mineral industry of Portugal during 1980 in terms of both value and number of personnel employed. About one-half of the value of minerals produced in the country can be attributed to the production of stone. About 1,000 companies were estimated to be producers, with sizes ranging from small family-run quarries to large companies producing from several deposits. Marble was the most valuable product, and limestone was the largest by volume. Marble was produced mostly around the cities of Vila Vicos, Borba, and Estremos, and this region accounted for about 85% of Portugal's marble production. During 1979-80, the major producers in the area were: Marmores e Materias de Construcao Lda. (Marmetal); Marmores do Condado S.A.R.L.; Companhia Industrial de Marmores de Estremor Lda. (Marmor); and Sociedade Lusco-Belga de Marmores, S.A.R.L. (Solubema).

The major limestone producing areas were found in the area between Leiria, Lisbon, and the Tagus River. Cement companies own their limestone quarries and were the largest producers of limestone, about 50% of the total. Siderurgia Nacional purchases limestone from independent producers operating at Arrabida, located about 30 kilometers north of Lisbon. Granite was produced by a large number of small companies in the north in the Districts of Braga, Viana do Castelo, Pôrto, Vila Real, and Viseu.

Slate production came from the area around Valongo in the Pôrto District. Seven companies produced slate during 1980: Empresa das Losuas de Valongo, S.A.R.L.; Pereira Gomez e Carvalho Lda.; Fonseca, Costa e Ca Lda.; Companhia Portuguesa de Ardosia Lda.; Exportadora de Ardosias Lda.; Balterejo, Sampaio e Ca. Lda.; and Exploracao Mineira de Valongo Lda. (Emir-

al).

MINERAL FUELS

The energy demand of Portugal was almost completely met by imports of crude oil, high-rank coals, and coke. Portugal did not produce natural gas or crude oil, and coal, mostly anthacite, remained the principal fuel produced in the country.

Coal.—West German mining experts, working under terms of a Technical Cooperation Agreement between the Governments of Portugal and the Federal Republic of Germany, assisted in expanding capacity of the only Portuguese coal mine, Germunde, also known as the Pejão Mine, located in northern Portugal and operated by the Empresa Carbonifera do Douro S.A.R.L. During 1980, mining equipment made in the Federal Republic of Germany and valued at 1.1 million German marks, or about $500,000 was delivered to the mine site. A nearby powerplant, which in the past used almost all coal produced at Pejao, will remain the major consumer.

Petroleum and Natural Gas.—Portugal did not produce crude oil and natural gas during 1980. Geophysical exploration was carried out near the townships of Seixal, Barreiro, and Palmela in cooperation with specialists from Spain. At yearend, results of the exploration were studied, but no decision was made to start drilling.

The first onshore well drilled since 1962, Campelos No. 1, was spudded in by Sceptre Resources of Portugal near Caldas Rainha, 55 kilometers north of Lisbon. The drilling contractor was Bawden Drilling of the United Kingdom, using a National 80-UE rig. Partners with Sceptre were Boe Valley Exploration of Portugal and Siebens Oil and Gas of Portugal.

In addition, the Goverment of Portugal, through its Gabinet e para e Pesquisa e Exploração de Petroleo, concluded contracts for petroleum exploration with Exxon Inc. and Union Texas Inc. According to terms of the later contract, Union Texas is obliged to invest about $1.6 million during a 2-year period for seismic exploration. If the results of seismic work warrant, Union Texas was to drill two wells at a total cost of $46 million. The onshore concession covers 2,571 square kilometers near the township of Leiria, north of Lisbon. The earlier contract with Exxon had awarded three concessions (total area, 2,554 square kilometers) in deep waters off the southern coast (Algarve coast).

Portugal had the following petroleum storage capacities in use at the beginning of 1980, in cubic meters: Crude petroleum, 2,290,000; liquefied petroleum gases, 130,000; gasoline, 529,000; kerosine, 157,000; aviation gasoline, 7,000; jet fuel, 212,000; gas oil, 681,000; and fuel oil, 1,089,000.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary values have been converted from Portuguese escudos (Esc.) to U.S. dollars at a rate of US$1.00 = Esc56.

The Mineral Industry of Romania

By Richard Levine[1]

In 1980, economic growth in Romania often fell short of the planned target. Increases in many economic areas have been rapid compared with other East European countries, and margins between planned and actual performance at times reflect deviations from self-set ambitious goals.

In 1980, national income grew by 2.5% against a projected 8.8% growth, and gross industrial production grew by 6.5% against a projected 11.4% growth. Investment as a percentage of national income continued to average approximately 40%, and this high rate of investment has fueled Romania's economic growth.

Economic shortcomings in 1980 were attributed to poor weather for agriculture, large price increases for imported oil and raw materials, and the world economic state. Labor shortages in mining were experienced as soldiers, students, and workers from other parts of the country were mobilized to help during critical periods.

1981 plans call for smaller increases. National income and gross industrial product are each to rise by 7%. Investment is to continue at a lesser but still high percentage of the national income during the 1981-85 planning period.

Romania is not rich in mineral resources although it had been a net petroleum exporter. It is now a net petroleum importer and a net importer of other energy raw materials including coke, coking coal, and natural gas.

To reduce material costs, Romania is implementing its "new economic mechanism." The new economic mechanism stresses the use of net output instead of gross output to eliminate inputs purchased outside the enterprise, including energy and materials, being counted as production, and it stresses profit from sales to reduce production cost and eliminate the production of unwanted goods. To provide a more realistic assessment of production costs, it was decided in 1980 to raise the domestic price of raw materials to conform to their world market price. This measure went into effect on January 1, 1981. Also, as of January 1, 1981, it was decided to switch to a new single commercial rate of exchange for exports, imports, and internal exchange of 15lei=US$1.00[2] Other programs to reduce costs include recycling and reducing imports.

The 12th Romanian Communist Party Congress, which met in December 1979, approved a program to make Romania self-sufficient in energy and fuels in the 1990's. Plans call for intensified geological explorations to tap new petroleum and gas deposits including deep drilling and drilling on the Black Sea shelf. At the same time, greater use is to be made of coal as well as nuclear and hydroelectric power.

The State is also promoting research in the use of solar, wind, biogas, geothermal, and other potential sources of energy. These efforts will be conducted along with a concerted effort to promote savings in the use of energy and minerals.

PRODUCTION

In 1980, the production of several important mineral commodities fell far below planned goals. Production of crude oil again declined, and coal production fell far short of the 1980 goal of 54.1 million tons. The production of natural gas, however, exceed-

ed the plan. Steel production increased slightly, but was far below the planned target.

For many commodities, the production goals set for 1981 are lower than the unattained 1980 goals. For example, in 1981 coal production is planned to be 50.8 million tons compared with the 54.1-million-ton goal set in 1980; steel production, 14.665 million tons compared with 15.6 million tons; cement production, 15.86 million tons compared with 18.3 million tons; and crude oil production, 12.6 million tons compared with 15 million tons. Still, to achieve many of these goals it will require production increases much greater than occurred in 1980.

Table 1.—Romania: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Bauxite, gross weight	680,000	702,000	707,767	708,000	708,000
Alumina, calcined, gross weight	425,000	442,000	449,000	502,000	510,000
Ingot including alloys:					
Primary	[r]203,000	209,000	213,000	217,000	222,000
Secondary	18,000	17,000	18,000	19,000	19,000
Total	[r]221,000	226,000	231,000	236,000	[3]241,000
Bismuth, mine output, metal content[e]	80	80	80	80	80
Cadmium metal, smelter[e]	100	90	90	90	85
Copper:					
Mine output, metal content[e]	23,000	27,000	27,000	[r]28,000	28,000
Metal:					
Smelter:					
Primary	40,491	41,429	38,880	41,120	42,000
Secondary	5,000	4,000	4,000	4,000	4,000
Total	45,491	45,429	42,880	45,120	46,000
Refined, primary and secondary	38,000	40,000	40,488	42,000	42,000
Gold, mine output, metal content[e] troy ounces	60,000	65,000	65,000	65,000	65,000
Iron and steel:					
Iron ore thousand tons	2,835	2,467	2,511	2,523	2,300
Metal:					
Pig iron do	7,415	7,784	8,155	8,879	[3]9,012
Crude steel do	10,733	11,457	11,779	12,909	[3]13,175
Semimanufactures:					
Castings and forgings, finished do	993	1,028	1,097	1,176	1,220
Pipes and tubes do	1,216	1,320	1,419	1,500	1,500
Rolled products do	7,305	8,392	8,958	9,482	[3]9,319
Lead:					
Mine output, metal content	35,000	35,000	33,300	33,300	33,500
Metal, smelter, primary and secondary	42,465	41,702	42,815	40,900	42,000
Manganese:[e]					
Ore:					
Gross weight	80,000	80,000	80,000	80,000	80,000
Metal content	17,000	17,000	17,000	17,000	17,000
Concentrate, gross weight	28,000	28,000	28,000	28,000	28,000
Silver, mine output, metal content thousand troy ounces	1,220	1,125	1,030	965	1,000
Zinc:					
Mine output, metal content	67,000	62,000	60,000	60,000	60,000
Metal, smelter, primary and secondary	53,373	51,860	49,790	46,486	47,000
NONMETALS					
Barite	[e]85,000	[e]85,000	87,300	88,000	88,000
Cement, hydraulic thousand tons	13,088	13,875	14,688	15,598	[3]15,611
Clays:					
Bentonite	63,000	63,000	65,000	65,000	65,000
Kaolin	90,000	90,000	90,000	90,000	90,000
Diatomite[e]	40,000	40,000	40,000	40,000	40,000
Feldspar[e]	58,000	60,000	60,000	60,000	60,000
Fluorspar[e]	15,000	20,000	20,000	20,000	20,000
Graphite[e]	6,000	6,000	6,000	6,000	6,000
Lime thousand tons	3,320	3,446	3,657	3,829	3,900
Nitrogen, N content of ammonia do	1,659	1,792	2,257	2,332	2,400
Pyrite, gross weight[e] do	870	915	930	930	930
Salt:					
Rock salt do	NA	NA	1,657	1,650	1,650
Other do	NA	NA	3,082	3,070	3,070
Total do	4,210	4,535	4,739	4,720	4,720

See footnotes at end of table.

Table 1.—Romania: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Sand[e] thousand tons	NA	NA	1,367	1,400	1,400
Sodium compounds, n.e.s.:					
Caustic soda do	673	735	725	704	705
Sodium carbonate, manufactured, 100% Na_2CO_3 basis do	814	861	899	893	895
Sulfur:					
S content of pyrite[e] do	375	395	400	[r]400	400
Byproduct, all sources[e] do	98	110	120	130	140
Total[e] do	473	505	520	530	540
Sulfuric acid do	1,555	1,523	1,655	1,750	1,850
Talc[e]	60,000	60,000	66,000	60,000	60,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	91,282	100,433	108,964	95,122	95,200
Coal:					
Run-of-mine:					
Anthracite and bituminous thousand tons	8,696	8,637	8,794	9,299	9,600
Brown do	600	635	641	633	650
Lignite do	18,819	19,872	22,019	24,956	27,000
Total do	28,115	29,144	31,454	34,888	37,250
Washed (produced from above):					
Anthracite and bituminous:					
For coke and semicoke production do	1,924	2,154	2,450	2,205	2,300
For other uses do	5,187	4,993	4,968	5,903	6,000
Brown do	567	603	606	601	600
Lignite do	18,164	19,028	21,239	24,055	26,300
Total do	25,842	26,778	29,263	32,764	[3]35,200
Coke:					
Metallurgical do	2,472	3,148	3,458	3,066	3,100
Other do	357	396	384	385	385
Total do	2,829	3,544	3,842	3,451	3,485
Fuel briquets (from brown coal) do	NA	NA	711	720	730
Gas:					
Manufactured: Coke-oven million cubic feet	[e]37,000	NA	NA	NA	NA
Natural:					
Gross:					
Associated do	222,940	230,462	232,016	242,540	250,000
Nonassociated do	1,053,573	1,015,468	1,023,167	960,166	[3]996,000
Total do	1,276,513	1,245,930	1,255,183	1,202,706	1,246,000
Marketed do	1,136,432	1,203,526	1,211,697	1,161,100	1,202,900
Natural gas liquids thousand 42-gallon barrels	3,190	3,740	NA	NA	NA
Petroleum:					
Crude:					
As reported thousand tons	14,700	14,650	13,794	12,323	[3]11,500
Converted thousand 42-gallon barrels	109,559	109,186	102,806	91,843	85,710
Refinery products:[4]					
Gasoline do	38,395	37,961	42,440	41,514	41,500
Jet fuel and kerosine do	8,742	8,029	7,789	7,463	7,450
Distillate fuel oil do	46,901	48,356	52,324	54,301	55,000
Residual fuel oil do	50,829	50,989	60,912	67,393	70,000
Lubricants do	4,676	4,242	4,669	5,103	5,200
Other:					
Liquefied petroleum gas do	3,097	3,144	2,802	2,285	2,200
Asphalt do	3,951	4,357	4,400	4,218	4,200
Total do	156,591	157,078	175,336	182,277	185,550

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Aug. 4, 1981.

[2]In addition to the commodities listed, antimony, asbestos, gypsum, and a variety of crude construction materials are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Romanian sources do not indicate whether refinery fuel is reported as a part of the listed product yields. Moreover, additional minor products may be produced, but are not listed in official sources.

TRADE

In 1980, Romania's foreign trade turnover reached 340.3 billion lei.[3] Imports accounted for approximately 90% of the iron ore, 70% of the bauxite and crude oil, and 50% of the coking coal requirements. Although the Soviet Union is Romania's largest single trading partner, the country is not dependent upon it for the majority of its mineral imports. For example, in 1980 approximately 10% of Romania's imported crude oil (1,496,000 tons), 45% of its imported iron ore (7,230,000 tons), and 20% of its imported phosphates (197,000 tons) came from the Soviet Union.

Approximately three-fourths of fuel and raw materials imports came from market economy countries. Romania is a net importer of copper, lead, zinc, sulfur, and many other minerals. It exports large amounts of petroleum products along with metals, nonmetals, and precious and semiprecious metals and stones. Because of the increased price of raw material on the world market, Romania intends to increase its share of trade with the CMEA[4] countries to reduce its hard currency payments, and is seeking cooperative agreements with all countries. However, in 1980, despite its membership in CMEA, all petroleum imported from the Soviet Union was paid for in hard currency at Organization of Petroleum Exporting Countries (OPEC) level prices.

In 1980, Romania was engaged in cooperative ventures with the CMEA countries. It is one of the CMEA countries participating in the development of the Kiyembay Asbestos complex in the Soviet Union, and was scheduled to receive 15,000 tons of asbestos in 1980, increasing to 25,500 tons in 1981, and eventually to 30,000 tons by 1991. In 1980, Romania was scheduled to receive shipments of 1.5 billion cubic meters of natural gas from the Soviet Union through the Orenburg pipeline in conjunction with Romania's participation in the pipeline's construction.

Success has been achieved in arranging cooperative ventures for minerals with non-CMEA countries. Many of these ventures, however, are described in terms of their future potential, and it is not certain if and when deliveries are to begin. A number of cooperative venture agreements have been made with African states. The Romanian-Zambian joint enterprise "Mokambo" is to cooperate in the exploration and development of coal, nickel, lead, phosphate, molybdenum, uranium, and hydrocarbon deposits. In Kenya, the K.M.I.L. joint company is conducting geological surveys of nickel deposits. In Burundi, the Somiburom joint company is to participate in the exploration and mining of nickel deposits; in Tanzania, the Besaminco joint company is to explore and mine mineral resources; and in Mozambique, geological surveying is being conducted for coal and iron ore. Other cooperative ventures are either underway or being initiated with Guinea, Zaire, the Congo, Liberia, and Angola.

In North Africa and the Mideast, there is joint oil drilling and mineral exploration with Algeria, exploration with Morocco of copper deposits, and a cooperative venture for mining and concentrating phosphates in Egypt. Iraq, which supplied Romania with oil in 1980, signed an agreement to cooperate in oil prospecting, drilling, and refining operations. In 1980, an agreement was announced whereby Iran is to supply Romania with a large quantity of oil for hard currency, although it is uncertain whether this agreement will actually be put into effect. This agreement would result in a marked increase in deliveries from Iran, and would be comparable in quantity to the agreement negotiated with the former Shah's Government.

In the Far East in September 1979, the Romanian and Chinese Governments signed a cooperative agreement to mine coking coal in mainland China. Collaboration is to occur in the construction of mines, dressing plants, and other facilities. The Romanians are to receive one-half of the coking coal output. Initial design work for this project began in December 1979. Romania is also obtaining oil from China and imported approximately 770,000 tons in 1980.

In the Balkans, Romania is trying to increase trade and promote good relations. Romania imports minerals, including chromium ore and concentrate, from Albania; has established joint companies with Greece to market petroleum products; is cooperating with Turkey in the construction of a petroleum refinery; and is engaged in joint hydroelectric projects with Yugoslavia and Bulgaria.

Romania is also trying to increase trade with the developed market economy countries. In 1980, it entered into a separate trade agreement with the European Communities (EC) although the CMEA position is to negotiate with the EC as a block. This separate agreement was the first of its kind

between a CMEA country and the EC although Romania's official position is still to support joint EC-CMEA negotiations. Under the terms of this agreement, a range of 94 industrial products and raw materials is allowed to enter the EC countries.

The United States is one of Romania's important trading partners. During the first half of 1980, petroleum products, which had traditionally dominated U.S. imports, remained at their 1979 low of 16% of U.S. imports. Romanian imports of U.S. coal increased greatly in 1980 as shipments began in accordance with a contract with the Island Creek Coal Co., a subsidiary of the Occidental Petroleum Corp. According to this contract, Romania is to receive 2 million tons of coal annually for 20 years from a large coal mine being developed in Upshur County, W. Va.

Romania is giving much attention to reducing its hard currency indebtedness, which was estimated at $6.7 billion as of yearend 1979, with a debt-servicing ratio of 22%. Romania's debt-servicing ratio is the lowest among the East European countries.[5] Romania is also the only CMEA country belonging to the World Bank and the International Monetary Fund; and it has Most-Favored-Nation trading status with the United States.

Table 2.—Romania: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Bauxite	--	8,295	All to Austria.
Metal including alloys:			
Scrap	7,160	2,016	Italy 1,627; France 192.
Unwrought	[3]70,300	[3]65,000	Japan 10,330; France 8,131; Italy 5,127.
Semimanufactures	27,562	28,584	United States 6,856; Poland 6,718; Japan 6,679.
Arsenic trioxide, pentoxide, acid	80	150	All to Greece.
Chromium:			
Chromite	10	--	
Oxides and hydroxides	47	199	United States 114; Japan 85.
Copper:			
Sulfate	--	20	All to Greece.
Metal including alloys:			
Scrap	3,561	844	Italy 764.
Unwrought	5,423	5,350	All to West Germany.
Semimanufactures	260	242	Pakistan 200.
Iron and steel:			
Pyrite, roasted thousand tons	147	126	All to Hungary.
Metal:			
Scrap	3,412	1,142	Yugoslavia 764; Italy 369.
Pig iron thousand tons	114	51	Austria 32; Italy 10.
Ferroalloys do	4	20	West Germany 10; United Kingdom 3; Netherlands 2.
Steel, primary forms do	[4]641	[4]541	Yugoslavia 216; Italy 107; Japan 80.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	[4]324	[4]295	West Germany 40; Poland 23; Yugoslavia 14.
Universals, plates, sheets do	[4]757	[4]575	West Germany 35; United States 21; Japan 16.
Hoop and strip	231	309	Yugoslavia 288.
Wire thousand tons	[4]117	[4]147	West Germany 15; Pakistan 3.
Tubes, pipes, fittings do	[3]420	[3]389	West Germany 35; Poland 34; United States 14.
Castings and forgings, rough do	4	3	West Germany 3.
Lead:			
Oxides	5	3	All to Spain.
Metal including alloys, scrap	58	--	
Molybdenum metal including alloys, all forms	3	--	
Nickel metal including alloys, scrap	--	2	All to West Germany.
Platinum and platinum-group metals including alloys, unworked or partly worked value, thousands	$12	--	
Silver metal including alloys:			
Unworked or partly worked do	$1,037	$4	All to Italy.
Waste and sweepings[5] do	$10,400	--	

See footnotes at end of table.

Table 2.—Romania: Apparent exports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Tungsten metal including alloys, all forms	11	11	All to France.
Zinc metal including alloys:			
Unwrought	--	[6]100	Belgium-Luxembourg 49.
Semimanufactures	--	19	All to Morocco.
Other:			
Ash and residue, nonferrous	603	542	West Germany 530.
Oxides, hydroxides, peroxides	--	2,667	Pakistan 2,666.
Metalloids	199	16	All to Switzerland.
Nonferrous metals including alloys:[3]			
Unwrought	563	439	NA.
Semimanufactures	13,478	--	
NONMETALS			
Abrasives: Grinding and polishing wheels and stones	1	11	West Germany 9.
Asbestos	100	20	All to United States.
Barite and witherite	598	2,478	France 1,199; Italy 1,030.
Boron oxide and acid	529	370	Italy 160; Singapore 100.
Cement thousand tons	[3]2,934	[3]2,738	Egypt 903; Saudi Arabia 229; Pakistan 169.
Clays and clay products:			
Crude	650	3	All to Austria.
Products:			
Refractory	133	1,476	Yugoslavia 1,437.
Nonrefractory	5,218	5,922	Nigeria 3,711; Yugoslavia 1,208.
Diamond:			
Gem, not set or strung value, thousands	$106	--	
Industrial do	$39	$1,050	All to Belgium-Luxembourg.
Fertilizer materials:			
Crude, nitrogenous	1,600	5,044	All to Turkey.
Manufactured:			
Nitrogenous: Urea thousand tons	[3]1,043	[3]1,023	Turkey 188; Egypt 65; Morocco 46.
Phosphatic do	18	148	Turkey 96; Indonesia 47.
Other including mixed do	[3]1,205	[3]1,315	Thailand 133; Yugoslavia 44; Turkey 36.
Ammonia do	5	35	Yugoslavia 29.
Gypsum and plasters	28,203	27,989	All to Hungary.
Lime	7,633	9,489	Do.
Pigments, mineral: Iron oxides, processed	139	53	All to Greece.
Precious and semiprecious stones excluding diamond, natural value, thousands	$1	$3	All to France.
Salt thousand tons	[3]781	[3]841	Hungary 445; Yugoslavia 131.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[3]303,500	[3]238,600	Hungary 24,573; Egypt 16,827; Yugoslavia 15,718.
Caustic potash	317	515	Italy 407; Tunisia 50; West Germany 38.
Soda ash	[3]518,300	[3]457,400	Czechoslovakia 53,000; Thailand 24,753.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	172	547	Japan 463; Belgium-Luxembourg 50.
Worked	15,920	23,351	West Germany 16,179; Austria 3,593.
Gravel and crushed rock	120,946	121,428	Hungary 121,354.
Limestone	687	932	All to West Germany.
Sand, not metal-bearing	1,081	20	All to United Kingdom.
Sulfur:			
Elemental, other than colloidal	1	--	
Sulfuric acid	--	5,322	All to Yugoslavia.
Talc and steatite	22	88	West Germany 72.
Other:			
Crude	1,677	1,896	Hungary 1,538; West Germany 358.
Slag, dross, and similar waste	[r]98,195	119,199	All to Yugoslavia.
Oxides and hydroxides of magnesium, strontium, barium	25	--	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	5,906	996	All to Yugoslavia.
Carbon black	[3]45,400	[3]30,200	Sri Lanka 1,378; Thailand 579.
Coal and briquets:			
Anthracite and bituminous coal including briquets	300	--	
Lignite and lignite briquets	11	--	
Gas, natural million cubic feet	[3]7,063	[3]7,063	All to Hungary.
Peat and peat briquets	2,501	2,006	Austria 1,595; Italy 411.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	[3]20,502	[3]20,226	Netherlands 5,743; West Germany 5,321.
Kerosine do	2,906	([7])	NA.
Distillate fuel oil do	[3]18,016	[3]15,092	Turkey 4,469; West Germany 2,357; Netherlands 1,667.
Residual fuel oil do	[3]15,218	[3]17,005	Italy 4,542; Netherlands 1,249; Sweden 1,195.

See footnotes at end of table.

Table 2.—Romania: Apparent exports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products —Continued			
Lubricants and nonlubricating oils thousand 42-gallon barrels	[3]2,289	[3]2,615	Singapore 393; Brazil 289; Spain 267.
Other:			
Mineral jelly and wax do	[3]26	[3]31	West Germany 4; Ethiopia 3; Egypt 2.
Petroleum coke do	[3]578	[3]295	Italy 66.
Bitumen and other residues do	[3]51	[3]38	Austria 27.
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals	[r 3]78,200	[3]68,700	West Germany 7,189; Hungary 5,672; Italy 5,316.

[r]Revised. NA Not available.

[1]Owing to the lack of official trade statistics published by Romania, this table should not be taken as a complete presentation of this country's mineral exports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of Romania.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Official Romanian trade statistics.

[4]Quarterly Bulletin of Steel Statistics for Europe, United Nations, New York.

[5]May include platinum and platinum-group metals.

[6]World Metal Statistics, World Bureau of Metal Statistics, London, United Kingdom.

[7]Less than 1/2 unit.

Table 3.—Romania: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite	877,206	668,563	Greece 573,703; Yugoslavia 92,260.
Oxides and hydroxides	25,607	13,730	Hungary 8,816; West Germany 1,584; Netherlands 1,507; Turkey 1,500.
Metal including alloys:			
Unwrought	3,490	2,115	Hungary 2,095.
Semimanufactures	6,148	5,868	West Germany 2,157; Hungary 1,953; France 607.
Bismuth metal including alloys, all forms	--	3	All from West Germany.
Chromium:			
Chromite	2,285	2,924	Do.
Oxides and hydroxides	1	--	
Metal including alloys, all forms	--	17	All from Belgium-Luxembourg.
Cobalt:			
Oxides and hydroxides	5	--	
Metal including alloys, all forms	31	11	West Germany 8; France 3.
Copper:			
Ore and concentrate	4,000	1,840	All from Morocco.
Metal including alloys:			
Scrap	--	50	All from Italy.
Unwrought	27,129	20,934	Belgium-Luxembourg 9,232; Poland 7,074.
Semimanufactures	10,392	11,803	Poland 4,653; Belgium-Luxembourg 2,049; West Germany 1,842.
Germanium metal including alloys, all forms kilograms	--	500	All from West Germany.
Iron and steel:			
Ore and concentrate thousand tons	[3]13,843	[3]15,065	U.S.S.R. 4,224; Brazil 1,444; Liberia 1,257.
Pyrite, roasted	2,500	--	
Metal:			
Scrap thousand tons	[4]8	[4]10	United States 6.
Pig iron do	[3]527	[3]573	West Germany 71; France 49; Brazil 41.
Ferroalloys do	[3]169	[3]190	Spain 15; Portugal 8; U.S.S.R. 8.[5]
Steel, primary forms do	[4]556	[4]596	West Germany 61; Spain 20; Belgium-Luxembourg 15.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	[4]854	[4]546	Poland 92; Czechoslovakia 91; Hungary 84; West Germany 76.
Universals, plates, sheets do	[4]377	[4]262	West Germany 38; Spain 31; Bulgaria 30.
Hoop and strip do	[r 4]85	[4]37	West Germany 24; Hungary 9.
Rails and accessories do	[4]70	[4]61	Yugoslavia 23; Austria 17; France 5.
Wire do	[4]57	[4]59	West Germany 17; Austria 3; Italy 3.
Tubes, pipes, fittings do	[3]142	[3]112	West Germany 32; Czechoslovakia 15; Italy 15.

See footnotes at end of table.

Table 3.—Romania: Apparent imports of mineral commodities[1 2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Iron and steel —Continued			
Metal —Continued			
Semimanufactures —Continued			
Castings and forgings, rough thousand tons	5	[4]4	Hungary 2; Poland 2.
Lead:			
Ore and concentrate	7,420	30,326	Greece 22,770; Morocco 5,163.
Oxides	2,002	2,861	France 2,860.
Metal including alloys:			
Unwrought	4,459	15,066	Morocco 13,567.
Semimanufactures	1	5	All from West Germany.
Magnesium metal including alloys:			
Unwrought	4	406	United States 394.
Semimanufactures	23	57	West Germany 22; France 19.
Manganese:			
Ore and concentrate thousand tons	[4]109	[4]113	Brazil 44.
Oxides	710	784	Ireland 355; Greece 215; Spain 200.
Mercury 76-pound flasks	5,800	8,961	Spain 7,511.
Molybdenum metal including alloys, all forms	4	5	Japan 3; West Germany 1.
Nickel metal including alloys:			
Scrap	2	--	
Unwrought	6	2,103	Philippines 1,557; France 430.
Semimanufactures	530	516	West Germany 441; France 21.
Platinum and platinum-group metals including alloys, unworked or partly worked value, thousands	$2,792	$3,298	France $2,086; United Kingdom $565.
Silver metal including alloys, unworked or partly worked do.	$359	$367	West Germany $159; France $148.
Tin metal including alloys, unwrought	66	80	All from Belgium-Luxembourg.
Titanium:			
Oxides	2,396	1,119	Spain 450; West Germany 411; Italy 256.
Metal including alloys, all forms	--	5	Japan 3; West Germany 2.
Tungsten metal including alloys, all forms	7	10	France 5; Japan 4.
Zinc:			
Ore and concentrate	--	11,607	Argentina 9,507; Greece 2,100.
Oxides and peroxides	885	5,405	France 3,880; Yugoslavia 1,050.
Metal including alloys:			
Dust	501	2,300	West Germany 1,060; Belgium-Luxembourg 1,040.
Unwrought	6,504	3,506	Italy 3,006; Spain 500.
Semimanufactures	1,428	101	All from Poland.
Zirconium:			
Ore and concentrate	--	45	All from West Germany.
Metal including alloys, all forms	--	1	Do.
Other:			
Ores and concentrates	64,022	8,429	Greece 8,400.
Ash and residue, nonferrous	--	36	All from Japan.
Oxides, hydroxides, peroxides	151	80	Netherlands 34; Belgium-Luxembourg 13; Canada 13.
Metalloids	12,124	4,216	Portugal 2,200; Italy 905; France 803.
Base metals including alloys, all forms	962	104	Japan 68; Austria 12.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	1,575	1,653	Hungary 1,466; Italy 143.
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	$406	$751	United States $453; United Kingdom $296.
Grinding and polishing wheels and stones	4,890	3,647	Yugoslavia 1,385; Austria 938; Italy 435.
Corundum, artificial	NA	7,690	Yugoslavia 5,652; Italy 1,555.
Asbestos	11,068	10,759	Canada 8,032; United States 2,504.
Barite and witherite	8,857	17,290	Turkey 7,350; Thailand 6,500; West Germany 3,400.
Boron: Crude natural borates	30,600	12,501	Turkey 12,500.
Cement	12	97	Italy 72; Belgium-Luxembourg 25.
Chalk	254	398	All from France.
Clays and clay products:			
Crude	23,411	14,614	United Kingdom 7,409; Greece 4,434.
Products:			
Refractory thousand tons	[3]125	[3]114	Yugoslavia 26; U.S.S.R. 22; West Germany 11.
Nonrefractory	108	818	Yugoslavia 742.
Diamond:			
Gem, not set or strung value, thousands	$672	--	
Industrial do.	$1,306	$4,503	Belgium-Luxembourg $2,283; United Kingdom $1,742.
Diatomite and other infusorial earths	1,292	787	France 465; United States 263.
Feldspar and fluorspar	15,443	500	Italy 300; Morocco 200.

See footnotes at end of table.

Table 3.—Romania: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Fertilizer materials:			
Crude, phosphatic ____ thousand tons	r [3]2,231	[3]2,338	Morocco 654; United States 646; Syria 537.
Manufactured:			
Nitrogenous	180	50	All from West Germany.
Phosphatic	9,757	--	
Potassic, K_2O content ____ thousand tons	[3]162	[3]179	East Germany 82.
Other including mixed	149	75	All from Belgium-Luxembourg.
Graphite, natural	73	114	All from West Germany.
Gypsum and plasters	22	10	All from United Kingdom.
Lime	--	8	All from France.
Magnesite	94,118	41,154	Czechoslovakia 41,000.
Mica:			
Crude including waste	r240	12	All from Belgium-Luxembourg.
Worked	r837	23	All from France.
Pigments, mineral: Iron oxides, processed	1,285	617	West Germany 381; Japan 136; France 64.
Precious and semiprecious stones, excluding diamond value, thousands	$18	$22	France $18.
Pyrite	74,664	75,844	Yugoslavia 75,825.
Salt	6	3	Sweden 2.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	--	19	Netherlands 18.
Caustic potash	276	542	Yugoslavia 490; France 51.
Stone, sand and gravel:			
Dimension stone	144	131	Italy 125.
Gravel and crushed rock	426	508	France 323; Yugoslavia 111.
Quartz and quartzite	553	1,111	Sweden 890; West Germany 221.
Sand, not metal-bearing	507	3,339	Netherlands 3,210.
Sulfur:			
Elemental:			
Colloidal	593	1,330	Yugoslavia 1,130.
Other than colloidal ____ thousand tons	172	223	Poland 185; United States 37.
Sulfuric acid	14,052	4,400	Hungary 2,415; Bulgaria 1,885.
Talc	393	435	Italy 423.
Other:			
Crude	1,263	2,020	Italy 1,330; Netherlands 377; West Germany 309.
Oxides and hydroxides of magnesium, strontium, barium	5	--	
Halogens	23	18	Japan 7; Switzerland 5.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	33	41	Italy 40.
Carbon black	2,106	93	West Germany 65; Netherlands 23.
Coal and briquets:			
Anthracite and bituminous coal ____ thousand tons	r2,248	1,801	United States 569; Czechoslovakia 556; Poland 353.
Lignite and lignite briquets ____ do	430	148	Turkey 131.
Unspecified ____ do	r1,991	[6]1,896	NA.
Total ____ do	r [3]4,669	[3]3,845	
Coke and semicoke ____ do	[3]2,083	[3]2,896	West Germany 1,118; Czechoslovakia 275; France 238.
Petroleum:			
Crude ____ thousand 42-gallon barrels	[3]94,400	[3]104,375	Libya 16,024; Algeria 6,608.
Refinery products:			
Gasoline ____ do	35	33	West Germany 30.
Kerosine ____ do	8	6	Hungary 2; Italy 2.
Distillate fuel oil ____ do	23	3	Mainly from Greece.
Residual fuel oil ____ do	12	7	Ivory Coast 4; Greece 2.
Lubricants ____ do	20	23	Netherlands 6; West Germany 5; Yugoslavia 4.
Other:			
Liquefied petroleum gas ____ do	59	168	Italy 84; West Germany 52; Austria 32.
Mineral jelly and wax ____ do	2	2	West Germany 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11,469	11,380	U.S.S.R. 10,818; West Germany 533.

rRevised. NA Not available.

[1]Owing to the lack of official trade data published by Romania, this table should not be taken as a complete presentation of Romania's mineral imports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of Romania.

[2]Unless otherwise specified, all data are derived from official trade statistics of individual trading partners.

[3]Official Romanian trade statistics.

[4]Quarterly Bulletin of Steel Statistics for Europe, United Nations, New York.

[5]Silicomanganese ferroalloy only; total import from the U.S.S.R. not available.

[6]Presumably largely bituminous coal; of total officially reported coal imports in 1979, 2,840,000 tons was described as washed pit coal for coke manufacture, while 1,005,000 tons was not further described.

COMMODITY REVIEW

METALS

Ferrous mining and metallurgy employs approximately 107,700 workers and accounts for 7.7% of the country's industrial output, and nonferrous mining and metallurgy employs approximately 70,800 workers and accounts for 3.4% of the country's industrial output.[6] Romania is not rich in metals and is largely dependent upon imports to supply sufficient raw materials for metal production. The country is exporting precious metals, but there is a lack of reliable information regarding production of these metals.

The 1981 plan calls for geological exploration to locate new reserves of iron ore, nonferrous metals, and rare and precious metals. Also, greater use is to be made of rare and precious-metal deposits with poor and dispersed contents. Local industries as well as individuals are being encouraged to mine gold, silver, and other precious metals.

Plans call for expanded secondary recovery of iron, pig iron, iron and steel alloys, copper, aluminum, and other nonferrous metals. By 1985, Romania plans to supply through recycling 40% of its iron, 41% of its copper, and 40% of its lead requirements.

Aluminum.—Production of bauxite remained at its 1979 level, and production of alumina and primary aluminum ingots increased. In 1980, a second aluminum foil rolling mill began operations at Slatina. This mill was designed and built in Romania. Beginning in 1981, Slatina is to provide the country's entire supply of aluminum foil from 5 to 750 micrometers thick.

Copper.—Total copper production continued to increase, and future increases are planned based in part on the expansion of enterprises in the Moldova Noua and Rosia Poieni areas. Research has been conducted on copper preparation to make better use of the low-grade ores from these areas. In addition, the flotation installation at Moldova Noua is to be enlarged. Projected annual capacities for the Rosia Poieni and Moldova Noua Mines are given as 15 million tons and 9 million tons of ore, respectively, and production of copper ore is projected to increase by four times.

Gold.—President Ceausecu claimed that gold is still being mined from regions where it was mined 2,000 years ago and stated that substantial amounts of alluvial gold are contained in other areas. It was claimed that new prospecting areas for gold-bearing ores were discovered during the 1976-80 planning period. Individuals are being encouraged to mine gold from alluvial deposits. The unemployed and pensioners are to receive 150lei for every gram of fine gold obtained. Local industry is also being encouraged to engage in gold production. In October 1980, Romania was the world's second largest exporter of gold for sale in Switzerland with a reported 10 tons.

Iron and Steel.—In 1980, production of crude steel increased although falling short of the plan. Production of pig iron also rose, but that of iron ore declined.

Some problems in steel production were experienced in 1980. Shortages were reported in the delivery of widely used rolled products. These included shortfalls in the supply of billets from the Hunedoara and Resita complexes, which resulted in decreased pipe production. In addition, the steel industry exceeded its consumption level for coke, and this was blamed on the poor quality of coke and coking coal provided. Poor-quality electrodes and nonenforcement of provisions regarding the quality of scrap were faulted for the steel industry exceeding its norm for electrode consumption.[7]

A number of measures were stressed for eliminating problems. The use of alloy steel, especially in the machine building industry, is said to be unjustifiably high and an effort is being made to replace alloy steel with an improved carbon steel. Production of alloy steel in 1981 is to be directed toward those types of steel that reduce imports. Shortages of certain special alloy steels are forecasted for 1981 due to planning delays.[8] The importance of attaining the projected parameters for the new heavy plate rolling mill at the Galati complex was stressed for ensuring the necessary amount of metal for the machine building industry. Production of stainless and refractory steel plates is required to double in 1981 compared with 1980 production.

In 1980, production facilities that came into operation included a 100-ton electric furnace at the Calarasi complex, two 100-ton electric furnaces at the Tirgoviste complex, the first oxygen converter with a 160-ton capacity at plant No. 3 at the Galati complex, continuous casting machines for blooms at the Galati and Calarasi complexes, a 1,000-cubic-meter blast furnace at the Calan "Victoria" enterprise, a medium section rolling mill at the Braila "Laminor-

ul" enterprise, a wire rolling mill at the Zalau Tube enterprise, a hard steel wire drawing mill No. 3 at the Cimpia Turzii Metallurgical enterprise, and a stainless steel sheet and strip facility at the Otelinox enterprise of Tirgoviste.

Lead and Zinc.—The production of lead and zinc has declined from the production level at the beginning of the 5-year plan in 1976. Plans are to increase the production of both commodities during the next plan period. In 1981, lead production is projected to increase by 13.9% and zinc production by 8.9% over that of 1980. By 1985, plans are to obtain 40% of lead production from secondary materials. Construction is being completed of a metallurgical facility for electrolytic lead at the Copsa Mica nonferrous metallurgical enterprise.

Silver.—During the 1976-80 planning period, Romania claims to have discovered new prospecting areas for silver-bearing ores. As with gold, individuals are being encouraged to mine silver from alluvial deposits. Unemployed persons and pensioners are to receive 7.5 lei per gram of silver obtained.

NONMETALS

Romania produces a variety of nonmetallic mineral commodities. It is a net exporter of products such as sodium compounds, nitrogenous fertilizers, cement, stone, gravel, lime, and salt, and is a net importer of other products such as asbestos, pyrite, and magnesite. During the 1981-85 planning period, production increases are projected for many nonmetallic minerals including kaolin, bentonite, graphite, sulfur, limestone, pyrite, etc. To better exploit nonmetallic mineral deposits, local industry is being encouraged to mine building materials. In an effort to reduce energy and material costs, plans are to change production methods and to use less expensive materials in the production of cement and concrete.

Cement.—Cement production has been steadily increasing. However, because of the energy-intensive nature of cement production and the cost of raw materials, an effort is underway to alter current production methods. Production plans call for the share of dry processing to rise to 95% of total production by 1985. Dry processing is said to result in a 30% energy savings. The use of secondary materials is also planned to increase. In 1981, there is to be an increase in the use of ash from thermal and electric powerplants by five times over use in 1979 and in the use of blast furnace slag as additives.

In 1981, emphasis is to be placed on the modernization of existing enterprises to achieve fuel and materials savings. Only 5.6% of production increases in the Ministry of Forestry Administration and Construction Materials is to be based on new capacities being activated or attaining their planned parameters. Regarding increasing capacities, the expansion of the Alesd Binder and Asbestos Cement complex, scheduled for 1980, will make it the largest enterprise of its kind in Romania.

Clays.—Production figures for clays are generally not published and must be estimated. It was stated that in 1980 there was a failure to meet the extraction plan for certain clays. Shortages were cited in the supply of refractory materials including furnace linings, which caused negative repercussions at the Galati, Hunedoara, and Resita steel complexes.[9] In 1981, plans call for the production of refractory clay to increase by 10.9%. A refractory clay washing installation is under construction at Suncuius.

By 1985, production of kaolin is planned to increase by 40% and in 1981, by 12.5% over its 1980 level. A kaolin preparation unit at Parva is scheduled for completion in 1981.

Fertilizers.—In 1980, problems occurred in agriculture partly because of a lack of timely deliveries of fertilizers; and total fertilizer production in 1980 was reported to have declined.[10] Although Romania is an importer of fertilizer raw materials, it is an exporter of fertilizers and is one of Europe's leading exporters of nitrogenous fertilizers. Less than 50% of fertilizer production has been used for domestic agriculture. The issue has been raised as to whether it would be preferable to make a greater percentage of fertilizer production available for domestic agriculture because of the need for agricultural products. Also the expense of fertilizer production, caused by the rise in energy prices, coupled with the rise in price of agricultural products on the world market, indicates that it might be more advantageous to apply fertilizers to obtain increased yields rather than to simply export them.

Projections for 1985 call for urea to comprise the greatest proportion of nitrogenous fertilizer production, followed by ammonium nitrate and nitrochalk. For phosphate fertilizers, superphosphate concentrate is to replace simple superphosphate as the domi-

nant type. The greatest growth is to be in the production of complex fertilizers, which is to triple.

In 1980, it was reported that urea plants were under construction at the Bacau, Arad, and Slobozia fertilizer enterprises with a capacity of 1,300 tons per day for each plant. France's Coppee-Rust S.A. is the contractor for the three urea plants.

Sulfur.—Although Romania has been mining pyrite for its sulfur production, it also depends on imported raw materials. In 1980, work was described as being in the advanced stage for starting operations at the sulfur-bearing ore deposit in the Caliman Mountains, and production is scheduled to begin in 1981. This deposit is stated to have an annual capacity of 60,000 tons. During the 1981-85 planning period, sulfur production is projected to increase sixfold.

MINERAL FUELS

Romania's energy policy is directed toward diverting its limited oil and gas supplies from fuel uses wherever more economic substitutes exist in order to produce the more valuable hydrocarbon products. In electric power generation, it is intended to substitute lignite and oil shale and to develop hydroelectric and nuclear power.

For the 1981-85 planning period, energy consumption is expected to increase while the production of oil and natural gas is to be below their peak levels in the 1970's. Oil production has been stagnating despite the fact that a large percentage of the geological research budget is designated for the discovery of oil reserves. To compensate for the shortage of oil, coal production is planned to increase sharply until nuclear powerplants come onstream in the late 1980's. Emphasis is also being placed on the development of hydroelectric power. Along with hydroelectric and nuclear power, Romania intends to increase its share of solar and other nonconventional power sources.

Table 4 shows the planned changes in the sources of electric power generation. The total energy balance for 1979 and 1980 is shown in table 5.

Table 4.—Production of electricity, by source

(Percent)

Source	1979	1980[1]	1985[1]	1990[1]
Hydrocarbons	53.49	39.7	20	4-5
Coal and oil shale	26.66	40.0	55	44
Hydroelectric	17.46	17.6	20	24
Nuclear	--	--	--	17-18
Nonconventional (wind, solar, etc.)	2.39	2.7	5	10
Total	100.00	100.0	100	100

[1]Figures for these years are estimated Romanian plan figures.

Table 5.—Romania: Primary energy balance

(Million tons of standard coal equivalent)[1]

	Total primary energy	Coal (lignite, anthracite, bituminous) coke	Crude oil and petroleum products	Natural and associated gas	Hydropower
1979:					
Production[2]	80.8	16.0	18.1	45.3	1.4
Exports	11.6	--	10.9	.3	.4
Imports	27.4	6.2	21.0	--	.2
Apparent consumption	96.6	22.2	28.2	45.0	1.2
1980:					
Production[2]	82.3	17.0	16.9	46.9	1.5
Exports	11.7	--	11.0	.3	.4
Imports	31.9	6.2	23.5	2.0	.2
Apparent consumption	102.5	23.2	29.4	48.6	1.3

[1]One ton of standard coal equivalent (SCE)=7,000,000 kilocalories. Conversion factors used are hard coal, 1.0; lignite and brown coal, 0.33; coke, 0.9; crude oil, 1.47; natural gas, 1.33 (per 1,000 cubic meters); and hydroelectric power, 0.123 (per thousand kilowatt-hours).

[2]Production from production table and from Anuarul Statistic al Republicii Socialiste Romania, 1980 (Annual Statistics of the Socialist Republic of Romania, 1980), Bucharest, 1980.

Coal.—Coal production, which was planned to reach 54.1 million tons in 1980, fell far short of this goal. Romania has tended to set unrealistically high goals for coal production, which it fails to achieve, even though production increases.

In 1980, the coalfields in the Oltenia region were to produce 32 million tons of lignite, but by July 1980, output had already fallen 6 million tons short of the plan. Failures to meet targets were blamed in part on lack of delivery of equipment and inadequate use of existing equipment. Inability to meet production targets in the Oltenia region resulted in thermal powerplants not being adequately supplied.[11]

In an effort to aid production, workers from all parts of the country, as well as soldiers and students, were tasked to work in coal mines during critical periods. Along with production problems, on December 1, 1980, Agerpres reported one of the worst coal mining disasters which occurred in the Jiu River Valley and resulted in 49 deaths and 26 persons injured.

In 1981, efforts will be made to complete ontime the new lignite production facilities at the Tismana II, Jilt-South, Pesteana-North, Rosia de Jiu, and Moii Mines. Also in 1981, exploitation of lignite deposits is scheduled to commence at the Prunisor-Izvoru Anestilor and Husnicioara locales in Mehedinti County, with projected capacities of 150,000 tons per year and 490,000 tons per year, respectively.

Natural Gas.—While Romania's oil production fell in 1980, its production of natural gas exceeded the plan and was the only mineral fuel produced above the planned goal. Still, natural gas production has declined from the start of the 1976-80 planning period. By 1985, natural gas production is projected to increase from its 1980 level to 31 billion cubic meters, as natural gas is to be substituted for other fuels. In 1980, Romania was an importer of natural gas and is scheduled, for the period 1980-85, to receive 1.5 billion cubic meters annually from the Soviet Union through the Orenburg pipeline.

Nuclear Power.—In 1980, Romania had no nuclear powerplants in operation, but is planning by 1990 to supply about 18% of its electric energy through nuclear power. Canada had in 1978 extended Romania a $1 billion credit for the purchase of four Candu-type reactors, the first of which is to be commissioned at Cernovoda. In 1980, Romania negotiated a $320 million contract with an Italian-United States consortium composed of the Italian firm Ansaldo Societa Generale Elettromeccanica (ASGEN), a subsidiary of the State-owned conglomerate I.R.I. Finmeccanica, and the General Electric Co. According to this agreement, Romania is to receive two turbine generators for use with its nuclear reactors.

By using the Candu technology, Romania is able to use domestic nonenriched uranium. There has been a call for greater attention to exploration for new domestic uranium deposits. Furthermore, Romania has concluded agreements concerning uranium with Gabon and Zambia. Gabon, according to a 1979 3-year contract, is to deliver 100 to 150 tons of uranium annually starting in 1986. Details of the agreement with Zambia are not yet known, although the joint Romanian-Zambian mining company Mokambo is to extend its work to uranium mining.

Oil Shale.—In 1981, mining is scheduled to commence at an oil shale deposit, which is part of the Anina oil shale mining enterprise. This shale deposit has a projected annual capacity of 500,000 tons. By 1985, total oil shale production is projected to be 15 to 16.5 million tons and is to be a significant fuel for thermal electric power generation. The Anina thermal electric powerplant located in Caras-Severin County is to be the first to operate on oil shale and is scheduled to begin operations in 1981.

Petroleum.—The 1980 crude oil production of approximately 11.5 million tons was below the official target and the previous year's production. Gheorghe Vlad, Deputy Minister of Mines, Petroleum and Geology, attributed failure to meet planned production to a number of factors including delays in the supply of equipment, overly long periods between the drilling of wells and their exploitation, inadequate recovery procedures from older wells, and deficiencies in securing personnel. The major problem, the Minister stated, is that the volume of oil deposits discovered and exploited is below the amount of oil being extracted, leading to depletion of the oil supply.[12]

Projected output for 1985 is 12.5 million tons, which is below the peak amounts produced in the 1970's. Consideration was taken in setting this goal on maintaining an adequate level of reserves. Plans for the 1981-85 period call for intensified geological research and for improving recovery from existing wells. Large sums are to be expended for the expansion of geological exploration, including deep drilling and offshore

drilling on the Black Sea shelf. Romania commissioned an offshore drilling platform in 1976, the Gloria I, which has not yet produced significant quantities of oil. In 1980, a second offshore drilling platform, the Orizont, was launched with equipment still to be installed on it. It is the first of four Orizont platforms to be built.

According to Vasile Patilinet, former Minister of Mines, Petroleum, and Geology, during the 1981-85 period, increased recovery is to create 70% to 71% of the increase in resources and is to account for 20% to 22% of oil production compared with 55% to 57% and 14% to 16%, respectively, during the 1976-80 period.[13] The rate of recovery is to go from 31.5% in 1979 to approximately 40% by 1985.

Romania has developed an export trade in refined petroleum products and relies on crude oil imports to achieve its refining capacity. Increasingly high-priced imported oil makes refining less lucrative and more dependent on uncertain supplies. In 1980, approximately 70% of the crude oil supply was imported, and, in addition, there was underutilization of refining capacity. Crude oil imports in 1980 were approximately 16 million tons, of which 1,496,000 tons came from the Soviet Union and were paid for in hard currency. Crude oil deliveries from two other major suppliers, Iran and Iraq, were interrupted due to their war, and this was reported to have adversely affected the Romanian economy. Another major supplier in 1980 was China, which provided approximately 770,000 tons. 1981 plans call for a reduction in total imports of crude oil to 12.5 million tons.

Other.—*Hydroelectric Power.*—In 1980, hydroelectric power accounted for approximately 18% of electric power generation and is projected to increase to 20% in 1985 and 24% in 1990. Along with the construction of large hydroelectric powerplants, a major emphasis is to be placed on the construction of numerous small hydroelectric powerplants supplying between 5 and 5,000 kilowatts.

A significant increase in hydroelectric power is to be achieved through cooperative ventures. Upon the completion of the joint Romanian-Yugoslav Iron Gates II, and the joint Romanian-Bulgarian Turnu Magurele-Nikopol hydroelectric powerplants, Romania is to receive annually 1.2 billion and 2 billion kilowatt-hours, respectively. An agreement with Bulgaria was reached in 1980 to build a joint hydroelectric powerplant in the Cernavoda region entirely on Romanian territory.

Nonconventional Energy Sources.—In 1980, approximately 2.7% of electric power generation was from nonconventional energy sources (solar, wind, geothermal, biogas, etc.), and this percentage is planned to rise to 5% by 1985, 10% by 1990, and 20% by the year 2000.

Production of solar energy equipment is in progress. For example, the Sadu mechanical enterprise is organizing the production of solar panels. In 1980, it produced 2,400 solar panels; in 1981, it is targeted to produce 70,000, and in 1985, more than 250,000. Efforts to harness wind-power are underway. Construction was reported of a wind-powered electric plant in the Semenicului Mountains in the Banat region. Although its capacity is only about 5 kilowatts, it is to be the first of a number of such plants with higher output in that area. Research is also progressing on the construction of wind turbines. To discover and make greater use of geothermal waters, a research unit has been established in Oradea. Using geothermal waters, it is envisaged by 1985 to supply energy with the caloric equivalence of 500,000 tons of conventional fuel. As part of the program to utilize nonconventional sources, local industry is being encouraged to utilize and to produce components for these sources.

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[1]Foreign mineral specialist, Branch of Foreign Data.

[2]In addition to establishing a new single commercial rate for the leu of 15lei = US$1.00 = 1.00 convertible ruble, as of February, 1981, a new tourist exchange rate for the leu was established of 11lei = US$1.

[3]In 1980, for the first time, Romania began reporting its foreign trade figures in lei rather than foreign trade (valuta) lei. However, the replacement of the foreign trade leu with an exchange rate of 4.47lei = US$1.00 by a single commercial rate of 15lei = US$1.00 was only to take effect in January 1981. Using the new single commercial rate instead of the foreign trade rate, foreign trade would have grown by approximately 10% in dollar value in 1980 instead of the reported 23.2%.

[4]CMEA—Council for Mutual Economic Assistance. Its current members include Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R., and Vietnam. Yugoslavia obtained permanent observe status in 1965.

[5]U.S.-Romania Trade Trends, January-June 1980, U.S. Department of Commerce, International Trade Administration, September 1980, p. 17.

[6]The figure of 3.4% for the percentage of output for nonferrous metallurgy is presumably for 1980 and was taken from Revista Economica (Economic Review), Bucharest. No. 3, Jan. 16, 1981, pp. 12-13. In 1979, this figure was 3.2%. The other figures are for 1979. All 1979 figures were taken from Anuarul Statistic al Republicii Socialiste Romania, 1980 (Annual Statistics of the Socialist Republic of Romania, 1980). Bucharest, 1980, pp. 156-157, 200-201.

[7]Scinteia Bucharest. Nov. 27, 1980, pp. 1-3.

[8]Work cited in footnote 7.

[9]Era Socialista (Socialist Era), Bucharest. No. 18, Sept. 20, 1980, pp. 12-15, 51.

[10]Scinteia Bucharest. Jan. 30, 1981, pp. 1-3. Era Socialista (Socialist Era), Bucharest. No. 23, December 1980, pp. 8-11, 52.

[11]Revista Economica (Economic Review), Bucharest. No. 31, Aug. 15, 1980, pp. 9-10, 17.

[12]Scinteia Bucharest. Nov. 20, 1980, pp. 1-2.

[13]Revista Economica (Economic Review), Bucharest. No. 35, Aug. 31, 1979, pp. 4-6.

The Mineral Industry of Saudi Arabia

By Peter J. Clarke[1]

Substantial increases in petroleum revenues continued to fuel the development of the Saudi economy in 1980. Petroleum revenues topped $100 billion[2] for the first time in 1980, and comprised over 60% of the total gross national product. Petroleum, both crude and refined, and natural gas liquids (NGL) were the major exports. Emphasis continued, however, on diversification of the economy and on adding value to Saudi Arabia's hydrocarbon resources. Construction of downstream processing facilities was given top priority in the country's third 5-year development plan (1980-84), and large investments were made in nonpetroleum heavy industries such as iron and steel, cement, and fertilizers. The nonoil sector achieved a nominal growth rate of about 20% for 1980, compared with a 9% growth rate for the economy overall.

Nonfuel mineral development received greater emphasis under the new 5-year plan. Exploration for copper-lead-zinc and gold deposits was being conducted by the U.S. Geological Survey, the French Bureau de Recherches Géologiques et Minières (BRGM), Hunting Survey's Ltd. (United Kingdom), and Shell Minerals Exploration Saudi Arabia. Development continued on the Red Sea minerals mining project, and a pilot program was to begin operation at the end of 1981. Mineral exploration was carried out under the auspices of the Directorate General of Mineral Resources (DGMR), and hydrocarbon development was under the control of the General Petroleum and Mineral Organization (Petromin), both of which were Government owned and sponsored.

Basic infrastructure development for Saudi Arabia's two major industrial centers, at Jubail on the Persian Gulf and Yanbu on the Red Sea, was nearly completed by the end of 1980. Jubail was to be the site for two major export refineries, five petrochemical projects, an iron and steel mill, and an aluminum fabrication plant, as well as secondary support industries and a residential community to house 300,000 people.

Industrial development in Yanbu, which began as little more than a sideshow to Jubail, took on much greater significance in the wake of the Iran-Iraq war. Yanbu was to become a major crude oil and NGL export terminal, giving the Kingdom its first outlet on the Red Sea, and avoiding the vulnerable Strait of Hormuz. Yanbu was to house a gas fractionation center, an export and lubricating oil refinery, and a petrochemical plant. The harbor at Yanbu has been expanded from two berths to nine, with five special-purpose, artificially created harbors alongside each industrial plant, and separate terminals for crude oil and NGL export.

Saudi Arabia's third 5-year Economic Development Plan reflected the progress the Kingdom has already made toward industrial development and diversification. Government spending shifted away from basic infrastructure and into "productive" investments, such as heavy industry, agriculture, and mining. Saudi Arabia's goal was to become an industrial processor of its own resources, thereby increasing the value added to its raw materials. Combined with this emphasis on resource development, the Government gave high priority to increasing the number of Saudi nationals owning and operating major industries. New limits were placed on the growth of expatriate labor, whose numbers reached over 2 million in 1980, and greater attention was paid to increasing Saudi participation in joint ventures. The Saudi Government completed

its full takeover of the Arabian American Oil Co. (Aramco) late in 1980. The company, originally a partnership of American oil companies, was gradually bought out by the Saudi Government, and the remaining 40% share was purchased in March for $1.5 billion, thereby ending 47 years of foreign ownership of Saudi Arabia's oil concessions.

The Saudi Government, through its expenditures, was the engine of economic growth. The runaway inflation of 40%, brought on by free spending from 1974 to 1977, was under tight control by 1980. In 1977 and 1978, expenditures and revenues were kept in balance, and budget allocations were kept constant in real terms. Tight controls on spending managed to reduce inflation to around 8% in 1980, despite a 27% increase in budget allocations in fiscal year (FY) 1980-81 budget. Even with this increased spending, the Government was expected to run a substantial surplus in its current accounts. The Saudi Arabian Monetary Agency (SAMA) was in charge of investing these surpluses to receive a maximum return. SAMA has traditionally invested in Government bonds or in quasi-governmental organizations with official guarantees, and more recently has moved into private bond issues, mostly of top U.S. corporations. Estimates place nearly 80% of Saudi investments in dollars, equally divided between deposits and securities, but with less than 50% in the United States itself. SAMA's total assets in 1980 were estimated at $75 billion.[3]

PRODUCTION

Crude oil production in Saudi Arabia reached its highest level ever in 1980, as production ceilings were raised from 9.5 to 10.5 million barrels per day to accommodate countries affected by the Iran-Iraq war. The 10.5-million-barrel-per-day production level continued through the end of the year, creating an oversupply condition in the world market. The Saudi's attempted to use their dominant position in the Organization of Petroleum Exporting Countries (OPEC) to stabilize prices by keeping a downward pressure on the spot market price. Saudi Arabia's Arabian light (34° API) marker crude began the year at $26 per barrel, and was raised to $28 in April, $30 in August, and $32 in November, which was consistently the lowest price charged by any OPEC country.

Saudi Arabia was in the process of building the largest single gas-gathering and processing project in the history of the oil industry in 1980. By the close of 1980, the NGL gas-gathering center in Shedgum and the fractionation plant in Ju'aymah were completed, and the third center at Uthmaniyah was to be completed by the end of 1981. Total capacity of the gas complex after completion of this phase was to be 700,000 barrels of NGL per day, to be used both for export and production of liquefied petroleum gas (LPG) and ethane. In 1980, 96 million barrels of LPG were produced, and 92 million barrels were exported, a 20% increase over 1979 levels. Plans were made to nearly double this output by 1983.

Production of refined products in the Kingdom continued to grow to 323.8 million barrels, a 6% increase from that of 1979. Expansion plans were underway at the Riyadh and Jeddah refineries, and six new refineries were to be constructed by the middle of the decade, bringing total refining capacity to over 900 million barrels per year.

Saudi Arabia's nonfuel mineral production was also scheduled for large-scale expansion. Nitrogenous fertilizer production rose to 330,000 tons of urea, the highest level ever, and a new ammonia-urea plant at Jubail was to come onstream early in 1981. The Saudi Iron and Steel Co. planned to construct an 800,000-ton-per-year direct-reduction steel plant in Jubail, and capacity at the Jeddah steel rolling mill was upgraded to 140,000 tons per year. The cement industry, already operating near capacity, commissioned two new cement plants during the year and was scheduled to add five more by 1982. The Kingdom also produced small quantities of other nonmetallic minerals, mostly for use in local construction. Saudi Arabia's mineral production is shown in table 1.

Table 1.—Saudi Arabia: Production of mineral commodities[1]

Commodity and unit of measure	1976	1977	1978	1979[p]	1980[e]
METALS					
Iron and steel: Crude steel thousand metric tons	5	5	5	45	50
NONMETALS					
Cement, hydraulic[2] do	1,104	1,267	1,800	2,200	3,500
Gypsum do	17	20	210	300	300
Lime[e] do	15	20	30	150	150
Nitrogen: N content of ammonia do	[r]102	[r]125	140	155	167
Sulfur:					
Native metric tons	1,326	1,160	1,083	1,100	1,000
Byproduct, all sources do	12,000	12,000	14,000	125,000	700,000
Total do	13,326	13,160	15,083	126,100	701,000
MINERAL FUELS AND RELATED MATERIALS[3]					
Gas, natural:					
Gross million cubic feet	1,667,904	1,719,816	1,544,960	1,700,000	1,769,000
Marketed[e] do	138,327	158,915	334,927	400,000	450,000
Natural gas liquids:					
Propane and butane thousand 42-gallon barrels	46,748	NA	NA	NA	NA
Natural gasoline and other do	19,665	NA	NA	NA	NA
Total do	66,413	70,000	91,009	100,000	105,000
Petroleum:					
Crude do	3,139,722	3,357,955	3,029,901	3,479,389	3,530,000
Refinery products:					
Gasoline do	9,545	12,334	19,716	21,316	22,000
Jet fuel do	4,346	2,054	202	248	250
Kerosine do	8,535	8,569	9,854	9,913	10,000
Distillate fuel oil do	26,914	32,116	37,486	34,991	36,000
Residual fuel oil do	104,528	96,887	95,423	97,997	98,000
Other:					
Liquefied petroleum gas do	47,021	57,571	65,326	79,523	80,000
Naphtha do	51,491	[r]49,010	48,285	51,250	51,000
Asphalt do	5,081	7,063	6,178	7,937	8,000
Unspecified do	--	--	1,085	1,560	1,600
Refinery fuel and losses do	9,499	9,608	[e]10,200	[e]10,200	10,200
Total do	266,960	[r]275,212	293,755	314,935	317,050

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through July 13, 1981.
[2]Data are for the Hejira calendar year, which corresponds closely to the Gregorian calendar year.
[3]Includes Saudi Arabia's 1/2 share of production in the Kuwait-Saudi Arabia Partitioned Zone.

TRADE

Saudi Arabia's balance of trade surplus continued its rapid growth in FY 1979-80, fueled by higher oil prices and high production levels. The surplus in the current account balance was nearly $40 billion, up over 300% from that of 1979. Exports of crude petroleum accounted for virtually all export earnings, but the Kingdom also exported refined products, and was the world's largest exporter of NGL. The major recipients of Saudi crude oil were Western Europe, Japan, and the United States. Most of the NGL exported was destined for Japan and Western Europe.

Total Saudi Arabian imports for 1980 were estimated at $32 billion and were increasing at an average rate of 28% per year. The United States supplied approximately $6 billion of the total, which was up 20% from the previous year, making Saudi Arabia the seventh largest market for American technology and products. Although total imports from the United States were up in FY 1980, the overall U.S. share of Saudi imports declined from 20% to 18%, and the U.S. share of construction contract awards dropped to 3%.

COMMODITY REVIEW

METALS

Exploration for metallic minerals continued in 1980, primarily in the Arabian Shield, where a total of 95 metalliferous prospects have been identified. Most of the deposits were located in volcanic rocks which hosted copper, lead, zinc, and iron minerals, but seven prospects have been drilled into basic plutonic rocks where chromite, nickel, platinum, and copper have been identified. A project was initiated by DGMR of Saudi Arabia to investigate sedimentary rocks underlying 1.5 million square kilometers of the Kingdom for deposits of lead and zinc.

Rio Tinto Finance and Exploration Ltd. (Riofinex), a subsidiary of Rio Tinto Zinc Corp. Ltd. (United Kingdom), concluded a preliminary review of mineral deposits in the Kingdom during 1977. Slated for further investigation were stratiform copper-lead-zinc deposits in the Ad Dawadimi-Jebal Sakhen Basin, metallic sulfides in the Wadi Wassat-Wadi Qatan district, iron ore at Wadi Sawawin, columbium and tantalum at Ghurayyah, and several other metallic mineral deposits.

The U.S. Geological Survey and BRGM of France were also investigating mineral deposits in central and western Saudi Arabia, while Hunting Surveys Ltd. (United Kingdom) continued surveying and mapping the Eastern Province. Shell Minerals Exploration Saudi Arabia, a subsidiary of the Royal Dutch/Shell Group, also began an exploration program in the Western Province. Shell was mainly prospecting for copper and zinc.

Feasibility studies were continuing in 1980 on mining the metalliferous muds of the Red Sea Atlantis II Deep Basin. The Saudi Sudanese Red Sea Commission (RSC) had spent over $300 million on research and development of seabed mining technology. Of the 17 minerals identified in the muds, lead, zinc, copper, silver, and cadmium were thought to be commerically minable. The Saudi Sudanese Authority for the Exploitation of Red Sea Resources was constructing a pilot program scheduled for completion by the end of 1981, and precommercial exploitation was to continue until 1988. Zinc and copper were to become the first commercially exploited minerals, starting in 1988. The mining process, developed by Orenstein and Koppel AG of the Federal Republic of Germany, involved agitating the muds free of the seabed, mixing with seawater, and then pumping to a processing ship—most likely a refitted ore carrier. The ore was to be concentrated on the carrier and then shipped by barge to a smelter-refinery, possibly located at the Yanbu Industrial Complex. The residual slurry was to be pumped back into the sea to a depth of 500 feet where tests have shown it will settle back to the seabed without an unacceptable amount of dispersion. The estimated value of ores in the Atlantis II Basin was around $3.5 billion, and the return from the mining operation was to equal that of the most efficient land mining operations.

Aluminum.—Saudi Arabia canceled its plans to build a 200,000-ton-per-year aluminum smelter in the Jubail industrial zone. The Government had drawn up plans to build the smelter in 1975 and commissioned Southwire Ltd. (United Kingdom) to perform a feasibility study in 1978. The decision to cancel the project was a result of both Bahrain's decision to expand capacity of its smelter from 126,000 to 170,000 tons per year and the commissioning of a new smelter in Dubai, with a 135,000-ton-per-year capacity. The Government of Saudi Arabia acquired a 20% interest in Aluminum Bahrain (Alba) in 1978.

Saudi Arabia joined six other Persian Gulf nations in a tentative agreement to establish the Gulf Aluminum Rolling Mill Co., at a cost of about $100 million. The plant, to be located in Bahrain, was to be integrated with the Alba smelter. Annual capacity of the plant, which was expected to come onstream in 1983, was expected to be 40,000 tons of semifabricated aluminum products. Saudi Arabia owned a 20% share, as did Bahrain, Kuwait, and Iraq; Oman and Qatar owned 10% shares.

Aluminum Products Co. (Alupco) brought an aluminum extrusion plant into production in 1978. The plant, located in Damman, was to produce 5,000 tons per year of aluminum products for the domestic market. There were approximately 45 aluminum fabricating plants operating in the Kingdom in 1980, with a combined capacity of 40,000 tons per year, most of which produced aluminum doors and windows and household manufactures. The Alupco plant in Damman was the first extrusion plant in

Saudi Arabia.

Copper.—The Arabian Shield Development Co. continued its exploration and development program in the Al Masani area. Drilling tests indicated significant amounts of copper, zinc, lead, silver, and gold in a north-south trending shear zone 30 meters wide and over 5 kilometers long. Copper and associated minerals were found along the strike of the zone in lenses and stringers. Watts, Griffis, and McQuat Ltd. (United Kingdom) was manager of the underground development project, and National Mining Co. was the Saudi partner.

Granges AB (Sweden) was continuing the search in 1980 for copper and precious metals in the Al Nagra and Al Safra regions, 250 kilometers northwest of Medina. Petromin reserved the right to enter into a joint venture with Granges in the event of a commercial discovery. Granges was awarded the exploration contract in 1978, but no development plans had been discussed by 1980.

Many other copper deposits of varying grades were located by the Riofinex mission, most of which were in the shield volcanic rocks. Copper deposits at Kutan and Jebel Sayid, under investigation by Noranda Mines Ltd. (Canada) and BRGM, respectively, were found to be uncommercial.

Gold.—Consolidated Gold Fields (United Kingdom) and Petromin continued their development plans for the Mahd-ad-Dhahab gold deposit, 280 kilometers northeast of Jeddah. Consolidated Gold Fields began exploration in the area in 1976, and Petromin took a 50% share in 1979. Exploration in the area revealed evidence of an open pit mine worked over 3,000 years ago, possibly the location of King Solomon's legendary mines of Ophir. Feasibility studies conducted by Gold Fields-Petromin established the existence of 1.2 million tons of ore containing 1.1 ounces per ton of gold, 4.3 ounces per ton of silver, and 0.8% copper. Gold Fields planned to start commercial production in 1981, with an expected annual output of 3 tons of gold and 10 tons of silver.

Iron and Steel.—The British Steel Corp. (BSC) continued its investigation of the Wadi Sawawin iron ore deposits located in northwest Saudi Arabia near the Gulf of Aqaba. BSC was awarded a $15 million contract to determine the tonnage and grade of the reserves at Wadi Sawawin. Initial estimates were 350 million tons of about 42% iron, with a high-silica (30%) and high-phosphorus (0.2% to 4%) content. Reserves appeared sufficient to establish a large-scale mining operation, but the ore grade was too low for use in commercial direct-reduction processes. The BSC, in conjunction with the London School of Mines, was investigating ways to upgrade the ore for use in Saudi Arabia's planned steel industry. A final report was due in 1981.

The Saudi Iron and Steel Co. (HADEED) was finalizing plans in 1980 for a major iron and steel complex to be located in Jubail. In December of 1979, the Saudi Iron and Steel Co., a joint venture owned 80% by the Saudi Arabian Basic Industries Corp. (SABIC) and 20% by Korf Stahl of the Federal Republic of Germany, signed a $208 million contract with Lurgi Chemie and Huettentechnik (Federal Republic of Germany) for the supply of two direct-reduction plants for the Jubail complex. The plants had a combined capacity of 800,000 tons per year, and utilize the Midrex direct-reduction process. In May 1980, a $236 million contract was awarded to Voest Alpine (Austria) for overall construction of the complex. The contract included installation of three electric hearth furnaces, each with 120-ton capacity, three six-stranded continuous casting machines, building infrastructure, and offices. The work was scheduled for completion early in 1983.

In October 1980, Saudi Iron and Steel Co. signed a $225 million contract with an international consortium headed by Mannesmann-Damag (Federal Republic of Germany) and including Schloemann-Seimag (Federal Republic of Germany), Redec Daelim Saudi Arabia, and Compagnie d'Enterprises Metalliques (France), to supply on a turnkey basis, two steel rolling mills and associated ancillary facilities for the Jubail complex. The first mill was to produce 6- to 32-millimeter reinforcing bars, and the other mill was to produce 6- to 12-millimeter wire rod coils. The combined production capacity of both mills was 800,000 tons per year. The output from the Jubail complex was to supply the domestic market, to reduce Saudi Arabia's heavy dependence on imported steel.

Iron ore to supply the plant was to be imported, pending the possible development of the Wadi Sawawin iron ore deposits. During the year, Saudi Arabia was negotiating with Brazil about importation of iron ore from the Carajas Mine, and technical assistance from the Rio Doce Staff. In re-

turn for a possible source of iron ore, Brazil was interested in Saudi financing for the Carajas mining project.

Modernization and expansion of the Steel Casting Co. of Jeddah (formerly Jeddah Steel Rolling Mill) was nearing completion at the end of 1980. The company, owned by SABIC, contracted Korf Stahl to upgrade capacity from 80,000 to 140,000 tons per year of reinforcing bars. The plant was to use imported billets until the Jubail complex begins operation early in 1983.

Construction was continuing on the National Pipe Co.'s plant in Damman. The company, owned 60% by Saudi interests and 40% by Sumitomo Metal Industries (Japan), was expected to produce 80,000 tons per year of spiral welded pipe. The plant was scheduled for completion early in 1981.

Uranium.—Exploration was continuing during the year for radioactive minerals. In 1978, DGMR signed an agreement with Minatome (France) for a 3-year survey of radioactive mineral occurrences throughout the Kingdom. Several deposits had been located by previous aerial surveys, in Jebel Said, Al Ahrayyat, Wadi Sawawin, and Yanbu, but none have proved commercially attractive. After general surveying and mapping, Minatome was expected to undertake more detailed prospecting in promising areas.

NONMETALS

Cement.—Cement consumption in Saudi Arabia increased from 1 million tons in 1973 to 10.4 million tons in 1978, nearly 80% of which was imported. The Kingdom's third 5-year plan called for an increase in productive capacity, from the current 3.5 million tons per year to 10 million tons per year by 1985. Companies from the Federal Republic of Germany, the United States, Japan, and the United Kingdom were supplying technology and training for the expansion. Saudi Arabia's planned and operating cement plants are listed in the following table.

Operating company	Location	Planned capacity (metric tons per year)	Startup date	Contractor	Value (million dollars)
Saudi Cement Corp	Hoffuf	1,000,000	1981	Polysius AG (Federal Republic of Germany) (FRG).	84
Yamama Saudi Cement.	Riyadh	1,000,000	1978	do	150
Yanbu Cement Co	Ra's Baridi	2,000,000	1980	KHD Industrialagen AG (FRG)	100
El Kasseim Cement	Buraydah	700,000	1980	do	--
Southern Province Cement Co.	Gizan	1,000,000	1981	Fuller Co. (United States)	--
Saudi Bahraini Cement Co.	Ain Dar	1,800,000	1981	Ishikawajima Harima Heavy Industries Co. (Japan).	--
Saudi-Kuwait Cement Manufacturing Co.	Kuwait-Saudi Arabia Partitioned Zone.	2,500,000	1982	Prospective Engineering Gestion (United Kingdom).	--
Arab Cement Co	Rabigh	2,500,000	1982	Unavailable	--

Fertilizer Materials.—Production from the Saudi Arabian Fertilizer Co. (SAFCO) rose to a record high 330,000 tons of urea in 1980, or over 10% more than the 1979 level. Of the 330,000 tons produced, 318,000 tons were exported, and the remainder was sold on the local market and used to replenish the company's inventory. Local consumption of urea has increased from 10,000 tons in 1977 to 32,000 tons in 1980, and was expected to reach 35,000 tons in 1981.

In February 1980, SAFCO inaugurated its new sulfuric acid plant at Damman. The plant was designed to produce 300 tons per day of sulfuric acid for domestic consumption, but operated at about 40% of capacity throughout the year. The plant, which was designed to utilize the large quantities of sulfur byproduct produced by SAFCO, was built by Sim Chem (Korea) at a cost of $10 million.

In January, Petromin announced its decision to sell 100,000 shares of its stock in SAFCO to the company's Saudi employees. Petromin formerly held 51% of the equity in the company, with the remaining 49% already in private hands.

The Jubail Fertilizer Co. (SAMAD), a 50:50 joint venture of SABIC and the Taiwan Fertilizer Co. (TFC), was scheduled to begin construction of its $361 million fertilizer complex at Jubail early in 1981. Pullman-Kellogg (United States) was contracted to design and supervise construction

of the complex. The plant was expected to produce 1,000 tons per day of ammonia and 1,600 tons per day of prilled urea. TFC was to purchase 60% of the output, for use in Taiwan and marketing to other Southeast Asian countries. About 40% of the cost of the project was to be financed by a loan from the Saudi Public Investment Fund. The complex was scheduled to come on-stream in mid-1982.

Phosphate.—Granges Engineering Ltd. (Sweden) was continuing its investigation of phosphate deposits in Turayf-Thaniyat and Turayf areas in northwest Saudi Arabia in 1980. Reserves were estimated at about 190 million tons of ore, with an average P_2O_5 content of 23%, and another 772 million tons at 18% P_2O_5. Direct shipping of the ore has proved impossible, but tests indicated that beneficiation and upgrading was possible to provide a commercially acceptable product. In the event of exploitation, the Government reserved the right to enter into a 50:50 joint venture with Granges. Petromin was studying transportation, water, harbor facilities, and associated infrastructure requirements to aid in determining if an economically viable project was possible. Riofinex was also studying the phosphate potential of the Turayf Basin, but no recommendations had been made by the end of 1980.

Magnesite.—DGMR, in cooperation with the French Societé d'Etudes de Recherches at d'Explorations Minières (SEREM), continued its investigation of magnesite deposits at Zarghat for Saudi Arabia Magnesite Ltd. Reserves at Zarghat, located south of Jebel Sayid, were estimated at about 1 million tons of 95% magnesium carbonate, with less than 2% silica. The Government and SEREM were studying the economic feasibility of mining and calcining magnesite at Zarghat.

Stone (Industrial-Ornamental).—The second 5-year plan initiated a program to inventory the country's reserves of nonmetallic industrial and construction materials. Several major deposits of limestone, clay, basalt, dolomite, and glass sand were located during this effort. DGMR opened a model quarry in 1980 to demonstrate modern quarrying techniques, and it also commissioned a modern stone cutting and polishing plant in Jeddah.

MINERAL FUELS

Natural Gas.—Portions of the first phase of Saudi Arabia's massive gas-gathering scheme began operating in the latter half of 1980. Aramco began in the early 1970's to design a gas-treatment center for the Berri Field. Shortly thereafter, the Government decided to expand the project to a large gas-gathering scheme, designed to process 220 billion cubic feet of associated gas per year. Construction and management of the scheme was awarded to Aramco, under the supervision of Petromin.

Aramco modified the construction of the Berri gas-gathering center to be integrated with the rest of the project. Berri reached full capacity in 1979. The remainder of the program involves several gas-gathering centers and secondary fractionation centers. Four NGL centers (Abqaiq, Berri, Shedgum, and Uthmaniyah) receive associated natural gas from the various oilfields, where it is sweetened and the first fractionation takes place. The output of these centers is sulfur, methane, and NGL. NGL is then piped to the secondary fractionation centers (Ras Tanura, Ju'aymah, and Yanbu) where further treatment produces ethane and LPG.

The various units of the project, their capacities, products, and startup dates were as follows:

Center	Design feed capacity	Product	Volume	Startup date
Gas-gathering (million cubic feet per day):				
Abqaiq	600	Sulfur-methane	400 tons per day sulfur, 2 billion cubic meters per year methane.	1973
Berri	600	do		1977
Shedgum	1,400	do		1980
Uthmaniyah	1,400	do		1981
Natural gas liquids (barrels per day):				
Ras Tanura	360,000	Ethane-LPG	370 million cubic meters per year ethane, 370,000 barrels per day LPG.	1973
Ju'aymah	270,000	do		1981
Yanbu	270,000	do		1984

The sulfur output from the project was to be utilized domestically in the production of sulfuric acid. The methane-fuel gas was for use by industrial plants in the eastern region, mostly at Jubail, by desalinization and power generating stations, and as feedstock for the Jubail Fertilizer Co.'s ammonia-urea plant and the Jubail Methanol project. The ethane produced from the secondary fractionation centers was to provide feedstock and fuel for the ethylene petrochemical complexes to be established at Jubail and Yanbu. LPG was for export or to provide feedstock for other future petrochemical projects.

All LPG output of the gas project was already sold under contract up to 1985. Among the buyers of Saudi LPG were Tokyo Gas-Shell International Gas (250,000 tons); British Petroleum (200,000 tons per year); Mitsubishi, Mitsui, C. Itoh, and Nippon Oil (250,000 tons per year each); and Dow Chemical (250,000 tons per year). The price of Saudi LPG in 1980 averaged about $310 per ton for butane and $315 per ton of propane. Butane prices dropped from a high of $330 per ton on January 1, 1980, to $300 per ton late in the year. LPG sales were about 3 million tons in 1980 and were expected to rise to 8.8 million tons per year by 1983, when all the facilities come onstream.

A project to store surplus NGL and ethane underground was nearing completion in 1980. Early in 1981, Aramco planned to begin pumping surplus ethane and NGL from the Ju'aymah fractionation plant into the underground reservoir in the Qatif Field. NGL was to be pumped into the north dome of the field, and ethane was to be pumped into the south dome.

The Saudi Government announced late in 1980, that as of January 1, 1981, it would take over all facilities for the production and export of NGL. The NGL system had been operating on a 50:50 joint venture basis between Aramco (Exxon, Socal, Texaco, and Mobil) and the Saudi Government. Aramco staff would continue to operate the facilities, and little disruption from the takeover was expected.

Petroleum.—*Production.*—Saudi Arabia produced approximately 3.53 billion barrels of crude oil in 1980, making it the largest producer of crude oil in the market economy countries, and second only to the Soviet Union. It was, however, the largest exporter of crude oil, with 1980 exports totaling over 3.2 billion barrels.

The Saudi Government completed the 100% takeover of all Aramco production facilities and oil concession rights in 1980. The Government bought out the remaining 40% share of Aramco's producing assets for an estimated $1.5 billion. The move came 7 years after the Government acquired its first 25% share in Aramco, which was established after World War II by Exxon (30%), Standard Oil of California (30%), Texaco (30%), and Mobil (10%). All facilities continued to be operated by Aramco personnel, but Petromin became full owner of all Aramco stock. The Arabian Oil Co. Ltd., owned 60% by Saudi Arabia and Kuwait and 40% by Japan, and the Getty Oil Co. owned and operated facilities in the Kuwait-Saudi Arabia Partitioned Zone.

There was a sharp increase in drilling during 1980, when 224 additional wells were drilled, a 55% increase over new wells in 1979. Cumulative oil production in Saudi Arabia, up to the end of 1980, was 40.6 billion barrels, and oil reserves were down only slightly from the 1979 level of 168.39 billion barrels to 167.46 billion barrels. Oil production from the Kuwait-Saudi Arabia Partitioned Zone amounted to 56.6 million barrels. Onshore oilfields in the Partitioned Zone were operated by Getty on behalf of Saudi Arabia, and Kuwait Oil Co. on behalf of Kuwait. The Arabian Oil Co. Ltd. operated the Partitioned Zone offshore fields on behalf of both Governments. Saudi Arabia's share from the Partitioned Zone was 50% of total production and reserves. Remaining crude oil reserves in the Partitioned Zone were 904 million barrels.

The Government became fully responsible in 1980 for setting production ceilings for all oilfields. The overall production ceiling was raised from 8.5 to 9.5 million barrels per day in the third quarter of 1979. Production remained steady at this level throughout most of the year, until a 10.5-million-barrel-per-day provisional increase was agreed upon in October of 1980 to offset the loss of supplies from Iran and Iraq. The 10.5-million-barrel production level remained in effect until the end of the year. These "incremental" crude supplies were allocated to countries most affected by the cutoff from Iran and Iraq. Included in the list were Brazil, Turkey, France, Japan, Italy, Spain, Greece, Yugoslavia, India, Pakistan, Morocco, and Somalia. As exports from Iran and Iraq slowly increased, the Saudis maintained the higher level of production in order to stabilize world oil prices and prevent

another round of rapid increases. At year-end 1980, the price of Arabian light crude oil was $32 per barrel.

Refining.—The Government of Saudi Arabia, through joint ventures with various major oil companies, planned a major increase in refining capacity to be completed about the middle of the 1980's. Of the five operating refineries in the Kingdom, two were undergoing multifold expansion, and six new refineries were being constructed or planned. Total output of refined products in 1980 was 323.8 million barrels, while domestic consumption during the year was about 200 million barrels, the balance of which was exported. Of the six new refineries in the planning or construction stage, four were to produce products mainly for export. By the mid-1980's, Saudi Arabia's refining capacity was estimated to approach 2.5 million barrels per day.

Aramco planned to construct a 250,000-barrel-per-day domestic refinery at Ju'aymah, which was intended to process high-sulfur 27° API crude oil from the Manifa Oilfield. Chevron Research, a subsidiary of Standard Oil Co. of California, was awarded a $2.5 billion contract for the process design of the refinery. Completion was scheduled for 1980.

Tenders were requested at the end of 1980 for construction of a 250,000-barrel-per-day export refinery at Jubail. Petromin and Shell Saudi Arabia Refining Ltd., a subsidiary of Royal Dutch/Shell (Netherlands), agreed to set up the refinery in April of 1979. No completion date was available.

Another major refinery, at Yanbu, was entering the construction stage at the end of the year. Petromin and Mobil Oil Corp. agreed in March 1979 to build a 250,000-barrel-per-day export refinery at Yanbu. Chiyoda Chemical Engineering and Construction Co. (Japan) was providing engineering, material and equipment procurement, and field supervision services for the 50:50 Petromin-Mobil venture. The project was to go onstream in 1984. Crude oil supplies were to be delivered via the East-West Transpeninsular Pipeline, due to be operational by mid-1981.

A third export refinery, a Petromin-Petrola International Saudi Arabia (Greece) joint venture, was to be constructed at Rabigh on the Red Sea coast. Output from the 325,000-barrel-per-day refinery was to be mainly for export. Construction was being carried out by Petrola, under a $2.6 billion contract, and engineering services were provided by Lummus Co. Ltd. (United Kingdom). The first phase of the project was to be completed by 1982.

Two large lube oil complexes were also in the design stage in 1980. The Jubail Lube Oil Refinery, jointly owned by Petromin (50%), Socal (25%), and Texaco (25%), was to produce 12,000 barrels per day of premium lubricating base stocks. C. E. Lummus, a British subsidiary of Combustion Engineering (United States), was preparing design specifications and cost estimates for the plant. Petromin also planned to construct a 5,000-barrel-per-day lube oil refinery in conjunction with Ashland Oil Co. (United States). The plant, which was to be located at Yanbu, was to cost $500 million. Petromin was studying the possibility of constructing a third lube oil complex, as a joint venture with the Arab Petroleum Investment Corp. (Apicorp). The plant, to be located somewhere on the Red Sea coast, would produce 4,000 barrels per day of lubricating oil, at an initial cost of $300 million.

Saudi Arabia's operating and planned refineries are listed in the following table.

Location	Ownership	Capacity (barrels per day)	Market	Startup date	Contractors
Ras Tanura	Aramco	750,000	Export-domestic	1945	--
Ras al-Kahafji	Arabian Oil Co	30,000	Domestic	1966	--
Mina Saud	Getty Oil Co	100,000	Export-domestic	1958	--
Riyadh	Petromin	20,000-120,000	Domestic	1974-1981	Chiyoda.
Jeddah	do	98,000-240,000	do	1968-1981	--
Ju'aymah	Aramco	250,000	do	1986	Bechtel-Chevron.
Jubail	Petromin-Shell	250,000	Export	--	Tenders requested.
Yanbu	Petromin-Mobil	250,000	do	1984	Chiyoda.
Rabigh	Petromin-Petrola	325,000	do	1982	Lummus-Petrola.
	Lube oil refineries:				
Jubail	Petromin-Socal-Texaco	12,000	Export-domestic	1985	C. E. Lummus.
Yanbu	Petromin-Ashland Oil Co.	5,000	do	--	--
Red Sea	Petromin-Apicorp	4,000	Tentative study	--	--

Petrochemicals.—The Saudi Arabian Government, through the state-controlled SABIC was planning to construct six major petrochemical complexes, all of which were to be completed about the middle of the decade. Methane and ethane from the Kingdom's huge gas-gathering project was to provide low-cost feedstock for the nearly $9 billion petrochemical industry. Output from all the plants could account for about 8% of the total world petrochemical output. Original plans were for seven petrochemical plants, but analysis showed that all the plants created more petrochemical capacity than the world needed. Two of the major projects, with Dow Chemical (United States) and the Saudi Petrochemical Development Corp. (SPDC) (Japan) consortium, were merged in order to reduce excess ethylene capacity.

Most of the remaining projects remained committed to construction. Many of the major U.S. oil companies were persuaded to enter joint ventures with SABIC on these plants in order to be eligible for incentive crude oil allotments offered by the Saudi Government. Crude oil entitlements were based on the formula of 500 barrels per day of additional crude oil supply per $1 million current dollars invested by the foreign partner. Fifteen-year agreements for incentive crude were signed by Petromin with U.S. Shell (Pecten), Mobil Oil Corp., SPDC, and Exxon. Saudi Arabia's planned petrochemical industry is shown in table 2.

Multimillion dollar subcontracts were signed by many U.S. and international firms for construction of the complexes. For the Yanbu complex, SABIC and Mobil signed agreements for use of patented technology with Scientific Design Co., Combustion Engineering, and Union Carbide, all U.S. companies. The plants were to utilize monoethylene glycol, ethylene, and polyethylene process technology. Bechtel Corp., C. F. Braun, and Fluor Corp. (all U.S. companies) were major contractors for construction of petrochemical plants. The SABIC-Shell plant at Jubail and the SABIC-Celanese Arabia Inc.-Texas Eastern Arabic methanol plant were already nearing the construction stage in 1980. Output from all the plants was primarily for export, although some production was to provide raw materials for petrochemical plants further downstream.

Pipelines.—Two separate but parallel pipeline projects were nearing completion at the end of 1980. Mobil Overseas Pipeline Co., a subsidiary of Mobil Oil Corp. (United States), and Petromin signed an agreement in 1977 for construction of a transpeninsular East-West pipeline, to transport crude oil from the Eastern Province (Abqaiq) to Yanbu on the Red Sea. Crude oil was to be used in the Petromin-Mobil and Petromin-Petrola refineries in Yanbu and Rabigh, respectively, as well as providing a new crude oil export terminal to avoid the unstable Persian Gulf. Southeast Engineering and Drilling Co. (Sedco) (United States) and Contracting and Trading Co. (Lebanon) built the 530-kilometer western section, through the mountains, under a $112 million contract, and Italy's Saipem (ENI) constructed the eastern portion. Total capacity of the 1,200-kilometer, 48-inch crude oil line was 1.85 million barrels per day, but expansion to 2.35 million barrels per day was likely, according to the management of Petroline, the Mobil-Petromin operating company. The pipeline was to be completed early in 1981.

Running parallel to the crude oil line was an East-West NGL pipeline. NGL was to be carried from the Shedgum gas plant in the Eastern Province, to Yanbu. The line's capacity was 270,000 barrels per day of NGL to be delivered to the Yanbu fractionation plant. Propane and butane were to be exported, while ethane was to be used in the SABIC-Mobil petrochemical complex in Yanbu. The $2 billion pipeline was built by Aramco and was scheduled to start operating in the first quarter of 1981.

Also nearing completion at the end of the year was a 140-kilometer pipeline linking the Riyadh refinery to the Khurais Oilfield in the east. The 300,000-barrel-per-day crude oil pipeline was built by Niigata Engineering Co. (Japan) under a $51.3 million contract awarded in 1978. The pipeline will supply feedstock to the Riyadh refinery, which was undergoing expansion from 20,000 to 120,000 barrels per day. Output from the Khurais Field was also being raised from 50,000 to 165,000 barrels per day to supply the refinery.

In December 1980, Petromin commissioned an international firm to perform a feasibility study for the construction of about 2,600 kilometers of product distribution pipelines. Areas under study were Riyadh-al Qasim (450 kilometers), Diba-Tobuk (250 kilometers), Mecca-Jeddah-al Tarf, Yanbu-al Madinah, Dhahran-al Hafur, Ras Tanura-Jubail-al Qaisumah, and Riyadh-al Kharg.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Saudi riyals (SRls) to U.S. dollars at the rate of SRls3.32 = US$1.00.

[3]Saudi Arabian Monetary Agency. Statistical Summary. March-April 1980.

Table 2.—Saudi Arabia: Petrochemical Industry

Location	Ownership	Products	Capacity (metric tons per year)	Design feed	Contractors	Startup date	Cost
Jubail 1	SABIC-Shell	Ethylene	656,000	Ethane	C. F. Braun (Engineer); Badger Co. (Engineer); Fluor Corp. (Contractor)	1985	$3 billion.
		Ethanol	281,000				
		Styrene	295,000				
		Ethylene dichloride	454,000				
		Caustic soda	255,000				
		Low-density polyethylene	260,000				
		Ethylene glycols	220,000				
Jubail	SABIC-Dow-SPDC	Ethylene	500,000	do	Unavailable	1986	$1.7 billion.
		Ethylene glycols	300,000				
		Polyethylene	310,000				
Do	SABIC-Exxon	Low-density polyethylene	260,000	do	Fluor Corp (Contractor)	1984	$1.08 billion.
Do	SABIC-Celanese Arabia Inc.-Texas Eastern Arabia.	Methanol	650,000	Methane	C. F. Braun (Engineer) Fluor Corp. (Contractor).	1983	$400 million.
Do	Saudi Methanol Co.-SABIC-Japan-Saudi Arabia Methanol Co.	do	600,000	do	Mitsubishi Heavy Industries Co. (Contractor).	1983	$200 million.
Yanbu	SABIC-Mobil	Ethylene	450,000	Ethane	Bechtel (Contractor)	1985	$2.1 billion.
		High-density polyethylene	90,000				
		Low-density polyethylene	200,000				
		Ethylene glycols	220,000				

The Mineral Industry of Sierra Leone

By William F. Keyes[1]

Sierra Leone experienced slow rates of growth during the 1970's because of the decline in its mining sector and the consequent erosion of the country's export base. Some improvement in export earnings occurred in 1979 and 1980 because of continued high prices for diamonds, and because of an increase in the quantity of cocoa sold on the international market. A sizable trade deficit, in the range of $50 million[2] each year in recent years, contrasted with a gross domestic product of about $900 million. The balance of trade deficit is a result of heavy reliance on imported goods and worldwide inflation, particularly in the price of imported crude oil.

The economy of Sierra Leone is based primarily on agriculture, but diamond mining, bauxite production, petroleum refining, and, recently, rutile production, are important. During the year, an agreement to expand bauxite mining was reached; iron ore mining was to be revived; kimberlite diamond mining was to be undertaken (production has been virtually all alluvial hitherto); and a seismic survey led to a decision to drill for oil offshore.

PRODUCTION AND TRADE

Sierra Leone depends on mineral exports for over one-half of its foreign exchange earnings, despite the fact that over 70% of its population derives its living from agriculture. The future outlook was uncertain, however, because the country depends on the extent of its mineral resources, which have not been fully explored, and on world demand for its mineral products, chiefly bauxite and diamonds.

Diamond production continued to decline in 1980, but this may be reversed if underground mining is successful. Bauxite production, the other large money earner, was up, with prospects for a further increase to 1 million tons annually. Bauxite is sold principally to the Federal Republic of Germany.

Table 1 gives production for the years 1976 to 1980.

Table 1.—Sierra Leone: Production of mineral commodities[1]

Commodity[2] and unit of measure	1976	1977	1978	1979	1980[p]
Aluminum: Bauxite, gross weight thousand metric tons	651	745	716	672	831
Diamond:					
Gem thousand carats	433	423	353	419	291
Industrial do	650	538	426	436	303
Total do	1,083	961	779	855	594
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	231	331	394	421	e430
Jet fuel do	109	101	102	277	e300
Kerosine do	185	199	213	105	e100
Distillate fuel oil do	407	464	501	586	e600
Residual fuel oil do	423	824	412	434	e400
Liquefied petroleum gas do	3	10	10	7	e10
Other do	--	--	--	2	e5
Refinery fuel and losses do	29	6	43	55	e55
Total do	1,387	1,935	1,675	1,887	e1,900
Salt thousand metric tons	180	180	180	200	200
Titanium: Rutile ore and concentrate, gross weight metric tons	--	--	--	10,000	50,000

eEstimated. pPreliminary.

[1]Table includes data available through Sept. 1, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is produced, but output is not reported and available general information is inadequate to make reliable estimates of output levels. Gold may occur, but data are not available for estimating production. Sierra Leone annually refines 4,000 to 10,000 metric tons of salt from imported crude marine salt, but this is not included in the body of the table because it would represent double counting of materials credited to the country where the salt was originally collected. This output would be in addition to that reported in this table.

COMMODITY REVIEW

METALS

Bauxite.—An agreement for exploration of the Port Loko bauxite deposit, northeast of Freetown, was signed between the Government and Swiss Aluminium Ltd. (Alusuisse) in May 1980. Conditions of exploitation remained as reported last year; the Government was to have a 50% share and would grant Alusuisse a 5-year tax holiday. One million tons of bauxite would be mined per year and converted to alumina at a plant to be built at Pepel, near Freetown.

Alusuisse's subsidiary, Sierra Leone Ore and Metal Co. (SIEROMCO), sole current producer of bauxite, planned to construct a washing plant near the Mokanji mining area in Southern Province and a drying plant at the Port of Nitti to handle up to 1 million tons per year of bauxite, which will allow for some expansion of output.

Gold.—In addition to the efforts of Eurocan Ventures Ltd. (Canada) in the Baomahun area, described last year, which were carried on in conjunction with Diamond Distributors Explorations Ltd. (a subsidiary of Harry Winston Inc. of New York), two other moderately sized companies were granted special exploration and prospecting licenses (SEPL's). In the Nimini hills area in eastern Sierra Leone, Eurocan (referred to as the Atlanta Co.) and Sierra Leone Diamonds Ltd., owned by Leon Templesman and Sons, were carrying out deep drilling near an area where National Diamond Mining Co. (Sierra Leone) Ltd. (DIMINCO) recovers some byproduct alluvial gold. In addition to these two groups interested in lode mining, Big Bent Spoon Ltd. (BBS), a private Sierra Leone and American company, obtained an SEPL for an alluvial area near Lake Sonfon, formerly a producing area.

Reported production in 1980 was a byproduct of DIMINCO's alluvial diamond mining operations; illicit production and exports were also considered to be significant.

Iron Ore.—Austromineral KG, a subsidiary of Vöest-Alpine AG of Austria, after carrying out a feasibility study, agreed to rehabilitate the mine at Marampa, closed since 1975. Austromineral was the latest in a series of foreign iron mining companies that had been approached by the Sierra Leone Government for that purpose. Exports over the refurbished railroad to the Port of Pepel would start in 1982. An Austrian Government-sponsored loan of $16 million and Sierra Leone Government equity capital of $6 million were reportedly to be provided.

Titanium.—Sierra Rutile Ltd. (SRL), a joint venture of Bethlehem Steel Corp.

(85%) and Nord Resources Corp. of Ohio (15%), which started production in 1979, recovered rutile by dredging alluvial sands at Mogbwemo, about 270 kilometers by road southeast of Freetown. A technical description of the operation was published.[3] A number of potentially exploitable deposits have been identified within the lease area, which was formerly worked by Sherbro Minerals Ltd., from 1966 to 1971. Rutile grades are high in the topsoil (averaging 2.5% TiO_2), and in the basal sands and gravels (up to 3.5% TiO_2); the entire stratigraphic column has an average content of 2.2% TiO_2 as rutile. Average depth of the column was not reported, but the dredge had a maximum digging depth of 15.25 meters below, or 6.1 meters above the waterline. Hydrocyclone desliming and Reichert concentrators on the dredge deliver a preconcentrate to a table plant on shore. Final magnetic separation produces a product containing 96% TiO_2, less than 1% ZrO_2, and less than 1% Fe_2O_3 at a rate of 13.2 tons per hour. Operating a planned 7,700 hours per year, the plant should reach an output of 100,000 tons of rutile per year; other heavy minerals are not recovered.

NONMETALS

Diamond.—Alluvial mining continued as virtually the sole source of diamonds, but development of a number of kimberlite pipes in the Yengema-Tongo region was planned. These are part of the diamond fields, presently yielding alluvial stones, which occupy an area of 20,000 square kilometers in the southeast around Kenema. Diamond production has been seriously declining since 1969 when it reached 2 million carats. DIMINCO, in addition to its alluvial production (about 170,000 carats in 1980, or about one-third of reported production), also produced some kimberlite ore from one pipe, but this output was limited to depths of 150 feet or less with the only available equipment (front-end loaders). A massive capital investment, probably about $100 million, would be required, to be undertaken by DIMINCO's parent organizations, the Sierra Leone Government (51%) and Sierra Leone Selection Trust, now a subsidiary of British Petroleum Ltd. (49%).

MINERAL FUELS

Coal.—Deposits of lignite of Pleistocene age were described.[4] Proven reserves, in the Koya area south of the Rokel River, about 25 kilometers east of Freetown, are about 2 million tons, although perhaps 20 million tons were considered probable. Washed samples gave proximate analyses of about 46% volatile matter, 34% fixed carbon, and 5% ash. The seams average 1.25 meters in thickness and lie beneath about 15 meters of overburden. The deposits were exploited sporadically in the past, but may also provide fuel for a newly established brick manufacturing industry 5 kilometers southeast of Freetown.

Petroleum.—A seismic survey was conducted in August by the *T. W. Nelson*, for Mobil Oil Corp., offshore near Turner's Peninsula, in the central coast. Promising signs of oil were revealed, and the vessel returned to Sierra Leone again at yearend to assist in locating the best drilling area. About 85% of a 73,000-square-mile concession belonging to the Aracca Petroleum Co., Oxoco Petroleum Co., and Sundance Petroleum Co. was farmed out to Mobil. Early in 1981, it was decided to drill a $6 million well in the concession by May 1981.

The 10,000-barrel-per-day capacity refinery of Sierra Leone Petroleum Refining Co. (SLPRC), owned by the Government and five foreign oil companies, was the only refinery in the country. During the year, SLPRC found the cost of imported crude increasingly onerous, and shortly after yearend, the Government announced an increase in the pump price of gasoline from Le3.00 to Le3.40 per imperial gallon ($2.35 to $2.66 per U.S. gallon).

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[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, the Sierra Leone currency, the leone (Le), has been converted at the average rate of Le1 = US$0.94 during 1980.

[3]Mining Magazine (London). Sierra Rutile. V. 144, No. 6, June 1981, pp. 458-465.

[4]Strasser-King, V.E.H. The Koya Lignite Deposits, Sierra Leone. Mining Mag., v. 143, No. 1, July 1980, pp. 48-51.

The Mineral Industry of the Republic of South Africa

By Miller W. Ellis[1]

For the third straight year, the mineral industry continued to dominate the economy of the Republic of South Africa and to be dominated by the gold industry, which contributed nearly 70% of its value. The country's mineral products had a new record value of $19.27 billion in a gross domestic product of $80.21[2] billion in 1980. The price of gold soared to a record $850 per troy ounce in January 1980 and remained at $600 to $700 during most of the latter half of the year, maintaining an annual average sales value of $616 per troy ounce, more than twice the average dollar price of $307 realized in 1979. Similarly, the state realized $4.87 billion in the form of tax and state's share of the profits in 1980, more than double the $2.19 billion realized in 1979. Although most of the increase in dollar value of its mineral products was due to gold, the country's coal industry was a major contributor also with a 31% increase in total sales value including a 35% increase in export sales.

The Republic's construction industry had a banner year with major projects at the South African Coal, Oil and Gas Corp. Ltd. (Sasol) plants, the Drakensburg diversion dam and irrigation scheme, the Koeberg power station near Cape Town, and a multitude of new mine plant or mine expansion projects. The new township in the near-desert country near the new Black Mountain Mine operated by Gold Fields of South Africa Ltd. (GFSA) in northwestern Cape Province was one example. The Government continued to control some of the mining industry through the Industrial Development Corp. of South Africa Ltd. (IDC), which indirectly controlled such companies as the South African Iron and Steel Industrial Corp. Ltd. (ISCOR), Phosphate Development Corp. Ltd. (Foskor), and the Alluvial Diamond Diggings of Alexander Bay, near the mouth of the Orange River. Sasol's operations included the company's original pilot plant, Sasol I, and its captive 6-million-ton-per-year Sigma Colliery at Sasolburg in the Orange Free State, the almost completed, partly commissioned Sasol II plant, and its mirror image Sasol III, under construction near the new Bosjesspruit Colliery at Secunda in southern Transvaal Province. Bosjesspruit also produced 6 million tons of coal in 1980 and was scheduled for 14 million tons in 1982 and 30 million tons in 1985, when Sasol III was to reach full capacity. A substantial portion of the capital for Sasol II and III was raised by public sale of stock in the enterprise.

In June 1980, the minimum starting wage for unskilled mine employees was increased by 14.3%. This was in addition to an "average minimum living level for an urban family of five" that has been established from time to time by the University of South Africa as a measure of the amount and quality of the housing, food, clothing, medicine, and social services provided free to employees. Throughout the mining industry, the total amount of wages paid to the employees in 1980 was more than 20% higher than that of 1979.

In May 1980, the chairman of the Uranium Enrichment Corp. of South Africa Ltd. (UCOR) was also appointed as chairman of a Committee of Inquiry into the Restructuring of Nuclear Activities in the Republic of South Africa. The committee was newly created by the Cabinet to monitor nuclear activities carried out with state funds and to recommend steps to ensure that the state's activities in this field were efficient.

PRODUCTION AND TRADE

In 1980, the Republic of South Africa produced and exported more chromite, gem diamonds, gold, platinum, and vanadium than any other country in the world and was one of its three top producers or exporters of antimony, asbestos, coal, industrial diamond, fluorspar, manganese, uranium, and vermiculite. Details of its 1980 mineral production are listed in table 1.

The manufacturing industries of the United States, Japan, and Western Europe continued to be highly dependent on many of the country's mineral commodities, and certain East European countries were also customers in 1980. With the changed Government in Iran, the Republic lost its trade ties with the Middle East but was able to find sources for decreasing amounts of crude oil elsewhere. Both the demand and the prices for many industrial commodities remained stable or weakened only slightly during most of the year, with coal prices showing increases for both domestic and export sales. More than 8 million tons of coal was exported to France in both 1979 and 1980. There was a 12% increase in the average price of diamonds by De Beers Central Selling Organization in February 1980 and a 1% increase in total sales value in terms of local currency. Major mineral imports continued to include crude oil and alumina. Details of exports from the Republic of South Africa are shown in table 2, and its imports are listed in table 3. Table 4 shows comparisons of the values of commodities exported and sold locally for the period 1978-80.

Table 1.—Republic of South Africa: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal	78,400	78,000	81,100	86,300	86,600
Antimony concentrate:					
Gross weight	18,341	20,053	16,395	20,086	22,378
Metal content	10,698	11,535	9,094	13,859	15,440
Beryl concentrate (11%-12% BeO)	3	3	4	1	(2)
Chromite, gross weight:					
More than 48% Cr_2O_3 thousand tons	25	53	33	33	20
44%-48% Cr_2O_3 do	1,312	1,607	1,524	1,633	1,989
Less than 44% Cr_2O_3 do	1,072	1,399	1,588	1,631	1,405
Total do	2,409	3,059	3,145	3,297	3,414
Columbium-tantalum concentrate kilograms	--	--	143	765	1,912
Copper:					
Mine output, metal content	196,880	208,287	205,745	190,591	200,683
Metal:					
Smelter	168,000	188,400	191,400	178,000	180,819
Refined	95,600	145,900	149,100	150,757	140,887
Gold, primary thousand troy ounces	22,936	22,502	22,649	22,617	21,669
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	15,663	26,481	24,206	31,565	26,312
Iron content do	9,789	16,948	15,492	20,202	16,840
Metal:					
Pig iron do	5,795	6,114	5,910	7,031	7,515
Ferroalloys, blast furnace and electric furnace:					
Ferrochromium[e] do	350	r350	r660	r780	800
Ferromanganese[e] do	350	r310	r330	r560	520
Ferrosilicon[e] do	r80	r75	r75	r149	162
Ferrosilicomanganese[e] do	r21	r22	r22	r45	70
Ferrosilicochrome[e] do	22	r23	r23	r28	38
Ferrovanadium[e] do	(2)	(2)	(2)	(2)	(2)
Total do	823	r780	r1,110	1,558	1,577
Crude steel:					
Ingots do	6,926	7,175	7,735	8,667	8,863
Castings do	230	201	167	201	205
Total do	7,156	7,376	7,902	8,868	9,068

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Semimanufactures:					
For immediate sale _ thousand tons	250	538	152	e550	e550
Hot-rolled products _ do	r4,694	4,844	5,634	r e6,500	e6,600
Iron castings _ do	r441	r1,351	1,382	433	480
Steel castings and forgings _ do	142	133	134	148	e140
Total _ do	r5,527	r6,866	7,302	7,631	7,770
Lead:					
Mine output, metal content	--	--	--	--	86,059
Smelter	22,000	24,000	23,600	23,300	35,400
Manganese ore and concentrate, gross weight:					
Metallurgical:					
Over 48% Mn _ thousand tons	270	263	262	296	290
45%-48% Mn _ do	1,517	1,198	1,131	998	942
40%-45% Mn _ do	209	577	430	763	997
30%-40% Mn _ do	3,358	2,839	2,357	2,897	3,099
Total _ do	5,354	4,877	4,180	4,954	5,328
Chemical:					
Over 65% MnO_2 _ do	3	(2)	--	(2)	2)
35%-65% MnO_2 _ do	95	171	118	153	166
Less than 35% MnO_2 _ do	--	--	19	76	201
Total _ do	98	171	137	229	367
Grand total _ do	5,452	5,048	4,317	5,183	5,695
Manganiferous iron ore (15%-30% Mn, 20%-35% Fe)	50,964	242,155	95,699	--	--
Nickel:					
Mine output, metal content	r27,000	r22,760	28,700	30,290	25,700
Metal, electrolytic	r22,371	r21,955	22,500	8,040	18,100
Platinum-group metals, metal content of concentrate, matte, and refinery products[e 3] thousand troy ounces	2,700	2,870	2,860	3,017	3,100
Silver:					
Mine output, metal content[e] _ do	2,825	3,135	3,110	3,240	5,500
Primary _ do	2,821	3,130	3,104	3,236	3,125
Tin:					
Concentrate:					
Gross weight	r5,625	6,139	6,120	5,706	e6,160
Metal content	2,799	2,864	2,886	2,697	2,913
Metal, primary	683	582	r637	819	1,100
Titanium:					
Rutile concentrate	--	r4,500	18,100	41,740	e48,000
Slag	--	--	90,700	286,700	e344,000
Uranium oxide (U_3O_8)	3,254	3,962	4,672	5,637	7,295
Vanadium:					
Vanadiferous slag, gross weight	e50,000	53,969	54,381	55,000	e60,000
V content:					
Of vanadiferous slag[e]	7,000	7,556	7,600	8,400	10,000
Of V_2O_5 and vanadate products[e]	2,875	3,682	3,650	3,900	5,000
Total	9,875	11,238	e11,250	e12,300	e15,000
Zinc:					
Concentrate:					
Gross weight	149,922	139,262	130,318	107,646	158,137
Metal content	74,961	69,631	65,159	53,823	79,068
Metal, smelter	66,200	76,000	79,100	75,400	81,400
Zirconium concentrate (baddeleyite)	11,252	16,825	e36,000	e82,000	e80,000
NONMETALS					
Asbestos:					
Amosite	78,898	66,983	40,526	39,058	51,646
Anthophyllite	1,506	550	--	--	--
Chrysotile	111,025	111,575	79,511	91,828	106,940
Crocidolite	178,411	201,056	137,288	118,301	118,148
Total	369,840	380,164	257,325	249,187	276,734
Barite	1,915	2,500	2,355	2,494	2,635
Cement, hydraulic _ thousand tons	7,049	6,573	6,824	6,900	7,200

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Clays:					
Attapulgite	--	--	2,773	[e]3,000	--
Bentonite	39,602	37,221	34,519	46,394	49,815
Fire clay	207,195	167,835	223,413	310,670	154,967
Flint clay	190,731	193,229	167,285	180,070	[e]160,000
Fuller's earth	--	--	258	919	720
Kaolin	59,733	88,619	122,024	148,740	107,563
Montmorillonite	--	--	1,299	1,267	1,115
Corundum, natural	142	138	18	74	10
Diamond:					
Gem[e] thousand carats	[r]2,858	[r]3,099	3,078	[r]3,539	3,403
Industrial[e] do	[r]4,165	[r]4,544	4,649	[r]4,845	5,119
Total do	7,023	7,643	7,727	8,384	8,522
Diatomite	619	666	930	1,059	584
Feldspar	46,138	51,230	52,545	47,416	52,247
Fluorspar:					
Acid-grade	210,874	234,649	297,591	387,305	[e]448,783
Ceramic-grade	39,502	65,660	14,907	8,477	[e]9,823
Metallurgical-grade	40,342	50,370	80,778	55,330	[e]64,112
Total	290,718	350,679	393,276	451,112	522,718
Gem stones, semiprecious:					
Emerald crystals kilograms	1,494	2,076	1,047	1,781	432
Tiger's-eye do	206,210	339,557	346,102	212,947	163,157
Graphite	530	911	583	394	--
Gypsum, crude	482,375	439,688	388,734	377,467	452,490
Kyanite-related materials:					
Andalusite	77,464	113,076	112,040	134,177	196,516
Sillimanite	25,733	15,455	9,540	19,574	16,194
Lime[5] thousand tons	1,387	1,504	1,875	1,721	[e]2,000
Magnesite, crude	62,858	49,219	37,407	65,336	59,975
Mica:					
Sheet kilograms	220	45	74	64	252
Waste	2,380	3,142	2,542	3,617	5,046
Nitrogen: N content of ammonia thousand tons	470	508	563	563	549
Phosphate rock, gross weight do	1,731	2,403	2,699	3,221	3,185
Pigments, mineral, natural:					
Ochers	1,288	1,561	1,244	1,244	710
Oxides	755	609	943	917	660
Umber	368	--	--	--	--
Total	2,411	2,170	2,187	2,161	1,370
Pyrite, gross weight	735,110	829,509	765,130	910,723	556,658
Quartz, quartzite, glass sand (silica) thousand tons	1,225	1,017	1,013	1,376	1,617
Salt	223,662	242,254	489,925	538,735	567,270
Silcrete	5,979	4,340	5,434	5,783	5,430
Stone, n.e.s.:					
Dimension:					
Granite:[5]					
Sawn slabs	32,316	24,084	9,341	[e]20,000	[e]20,000
Rough blocks	263,367	388,719	203,983	[e]168,000	[e]160,000
Marble	16,220	8,523	2,369	[e]2,000	[e]2,000
Crushed and broken:					
Limestone thousand tons	13,739	13,076	14,112	17,406	[e]20,000
Shale do	369	267	376	425	604
Sulfur:					
S content of pyrite do	294	332	219	319	195
Byproduct:					
Of metallurgy do	91	105	[e]100	[e]100	[e]100
Of petroleum do	27	28	[e]25	[e]25	[e]25
Total do	412	465	344	444	320
Talc and related materials:					
Talc	7,039	8,095	7,487	9,451	9,466
Pyrophyllite (wonderstone)	5,784	5,109	5,159	5,795	4,900
Vermiculite	222,077	165,419	209,093	191,573	185,699
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]	43,100	45,000	40,000	45,000	[e]45,000

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Coal:					
Anthracite ____ thousand tons__	2,459	2,559	2,150	3,309	3,895
Bituminous ____ do____	74,600	82,852	88,208	100,459	111,225
Total ____ do____	77,059	85,411	90,358	103,768	[11]5,120
Coke:					
Coke oven and beehive ____ do____	4,608	5,201	4,869	4,951	5,377
Gashouse, low- and medium-temperature do____	[e]110	[e]110	[e]110	[e]110	94
Petroleum refinery products:					
Gasoline____ thousand 42-gallon barrels__	29,783	30,083	30,090	30,660	NA
Jet fuel ____ do____	2,196	2,349	2,440	2,555	NA
Kerosine____ do____	3,132	3,338	3,333	3,285	NA
Distillate fuel oil____ do____	31,279	31,918	32,973	33,580	NA
Residual fuel oil ____ do____	22,027	22,036	22,178	22,630	NA
Lubricants ____ do____	2,228	2,262	2,240	2,555	NA
Other ____ do____	8,581	8,607	7,372	6,205	NA
Refinery fuel and losses____ do____	5,561	5,624	5,700	4,015	NA
Total ____ do____	104,787	106,217	106,326	105,485	110,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Sept. 21, 1981.
[2]Less than 1/2 unit.
[3]Includes osmiridium from gold ores, estimated at 2,500 troy ounces per year.
[4]Sales.
[5]Domestic sales plus exports. Production not reported.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite____	--	127	--	Netherlands 100; France 27.
Oxides and hydroxides ____	240	106	--	All to Sweden.
Metal including alloys:				
Scrap ____	132	60	--	Japan 49; United Kingdom 11.
Unwrought____	25,822	29,557	328	Japan 12,589; Taiwan 6,624; Republic of Korea 5,844.
Semimanufactures ____	274	2,527	215	Japan 761; Republic of Korea 755; Brazil 419.
Antimony concentrate ____	[2]3,173	[2]11,379	1,132	France 785; Japan 536.
Beryllium ore and concentrate____	25	34	34	
Chromium:				
Chromite____ thousand tons__	[2]1,423	[2]1,269	305	Japan 443; West Germany 264; France 106.
Oxides and hydroxides ____	1	1	--	All to United Kingdom.
Cobalt:				
Oxides and hydroxides ____	6	4	--	West Germany 2; Spain 2.
Metal including alloys, all forms ___	--	759	7	Japan 749.
Columbium and tantalum, tantalite concentrate____ kilograms__	[2]250	[2]4,414	889	NA.
Copper:				
Ore and concentrate____	48,837	72,001	--	All to West Germany.
Matte____	--	214	--	Do.
Sulfate____	597	342	--	All to Canada.
Metal including alloys:				
Scrap ____	1,498	1,088	36	United Kingdom 370; West Germany 277; Taiwan 119.
Unwrought____	235,553	181,601	2,508	NA.
Semimanufactures ____	2,958	6,859	5,413	NA.
Iron and steel:				
Ore and concentrate thousand tons__	14,328	17,079	107	Japan 7,197; West Germany 4,431; United Kingdom 1,654.
Pyrite, roasted ____	--	337	--	All to Belgium-Luxembourg.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	6,434	3,296	12	Italy 2,064; United Kingdom 495; Netherlands 317.
Pig iron, cast iron, powder, shot	18,776	102,208	37,899	Japan 22,290; Sri Lanka 8,942; West Germany 7,350.
Ferroalloys:				
Ferrochromium	NA	599,308	132,233	Japan 202,759; West Germany 125,998; Italy 38,993; France 31,836.
Ferromanganese	NA	444,989	329,983	Italy 45,238; United Kingdom 31,717; Canada 26,832.
Ferrosilicon	NA	27,556	5,077	Japan 19,549; West Germany 1,801; Sweden 1,012.
Ferrosilicomanganese	NA	33,399	8,000	West Germany 17,295; Italy 8,104.
Ferrosilicochrome	NA	33,983	--	Japan 22,756; West Germany 5,766; Italy 2,547.
Unspecified	NA	105,145	--	Canada 39,606; United Kingdom 34,493; Australia 19,594.
Total	982,256	1,244,380		
Steel, primary forms	110,629	173,193	6,339	Italy 38,523; United Kingdom 35,702; Republic of Korea 25,486.
Semimanufactures:				
Bars, rods, angles, shapes, sections	331,327	500,350	135,203	Hong Kong 159,417; United Kingdom 64,415; Canada 41,617.
Universals, plates, sheets	427,332	484,411	235,746	Hong Kong 36,598; West Germany 36,570; Canada 35,125.
Hoop and strip	1,445	822	--	Spain 359; Greece 184; Hong Kong 131.
Rails and accessories	1,598	283	--	Malawi 281.
Wire	10,209	15,802	6,729	Portugal 2,392; Sri Lanka 2,017; Hong Kong 2,015.
Tubes, pipes, fittings	28,858	72,241	55,464	Hong Kong 5,960; Malawi 3,681; United Kingdom 2,218.
Castings and forgings, rough	101	248	--	Canada 169; United Kingdom 52.
Lead:				
Ore and concentrate	--	206	--	West Germany 116; France 90.
Oxides and hydroxides	53	56	--	Canada 27; Australia 15; United Kingdom 12.
Metal including alloys:				
Scrap	210	249	--	West Germany 150; United Kingdom 99.
Unwrought	28,475	23,122	5,212	Italy 16,644; Republic of Korea 641; Portugal 387.
Semimanufactures	10	185	--	Taiwan 111; Hong Kong 61; United Kingdom 10.
Magnesium metal including alloys:				
Scrap	216	318	255	Brazil 36; West Germany 18.
Unwrought	144	17	--	All to New Zealand.
Manganese:				
Ore and concentrate thousand tons	2,532	3,055	80	Japan 660; France 506; West Germany 432.
Oxides and hydroxides	128	69	--	Portugal 18; Spain 18; United Kingdom 18.
Metal including alloys, all forms	17,434	19,282	5,546	Canada 7,811; Netherlands 2,916; Norway 967; Italy 957.
Molybdenum ore and concentrate	--	6	--	All to West Germany.
Nickel:				
Ore and concentrate	30,038	41,432	41,418	Spain 9; West Germany 5.
Matte and speiss	3,947	3,910	--	Norway 3,494; Italy 257; France 43.
Metal including alloys:				
Scrap	570	1,092	--	Canada 869; United Kingdom 117; Italy 50.
Unwrought	25,321	26,591	3,804	West Germany 7,066; Italy 3,527; Netherlands 2,946.
Semimanufactures	503	1,058	711	Brazil 77; Italy 46; Portugal 31.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$462,299	$792,737	$558,228	Japan $174,881; United Kingdom $33,542; Italy $5,291.
Silver:				
Ore and concentrate do	$3	$168	--	All to Israel.
Silver-bearing residues[3] do	$25	$2,862	--	All to Spain.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Silver —Continued				
Waste and sweepings[3] value, thousands	$796	$1,268	$476	Italy $280; West Germany $271; Belgium-Luxembourg $137.
Metal including alloys, unwrought and partly wrought ____do____	$12,267	$26,772	$39	United Kingdom $19,688; Italy $5,200; West Germany $1,509.
Tin:				
Ore and concentrate	5,684	3,727	31	West Germany 1,703; United Kingdom 917; Netherlands 828.
Metal including alloys:				
Scrap	368	114	--	Malawi 110.
Unwrought	216	1,108	253	Belgium-Luxembourg 379; France 360; Netherlands 71.
Semimanufactures	36	37	--	All to Sri Lanka.
Titanium:				
Ore and concentrate	7,321	42,845	9,815	Belgium-Luxembourg 21,764; West Germany 6,436.
Slag	--	27,144	27,144	
Oxides	--	892	543	Reunion 178; Taiwan 153.
Metal including alloys, all forms	--	155	155	
Tungsten ore and concentrate	59	80	3	West Germany 35; Sweden 24; Austria 17.
Zinc:				
Ore and concentrate	[2]41,600	[2]37,367	--	West Germany 29,672.
Oxides and peroxides	--	38	--	All to Sri Lanka.
Metal including alloys:				
Scrap	--	17	--	All to Italy.
Unwrought	8,160	33	--	All to Malawi.
Semimanufactures	10	98	46	Portugal 52.
Zirconium ore and concentrate	15,719	48,108	6,588	Japan 15,723; West Germany 10,970; Spain 7,406.
Other:				
Ores and concentrates	26,004	10,905	38	Switzerland 3,648; Australia 2,711; Canada 1,927.
Ash and residue containing nonferrous metals	36,193	70,784	10,790	France 23,014; Italy 18,255; Austria 9,870.
Oxides, hydroxides, peroxides	7,613	9,941	7,610	Canada 998; Belgium-Luxembourg 732; France 333.
Metals:				
Metalloids	16,289	17,442	1,520	West Germany 5,215; Australia 4,665; Netherlands 3,247.
Base metals including alloys, all forms	10,322	17,434	5,845	West Germany 3,088; Japan 2,965; United Kingdom 2,606.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	23	4,570	4,092	Taiwan 420; Australia 58.
Dust and powder of precious and semiprecious stones value, thousands	$13,372	$14,678	$9,744	France $3,669; West Germany $799; Sweden $230.
Grinding and polishing wheels and stones	47	138	--	Australia 99; Malawi 31.
Asbestos, crude	287,237	389,470	16,538	Japan 104,095; Republic of Korea; 40,133; Italy 38,935; West Germany 31,611.
Barite and witherite	--	25	--	All to Netherlands.
Boron materials: Crude natural borates	--	24	--	All to France.
Cement	42,720	19,457	206	Reunion 14,348; Malawi 4,775.
Clays and clay products:				
Crude clays:				
Bentonite	[2]722	[2]1,067	--	Taiwan 278.
Kaolin	[2]988	[2]1,263	--	West Germany 76.
Other	[2]91,856	[2]108,316	--	Switzerland 73,260; United Kingdom 25,002.
Products:				
Refractory including nonclay brick	2,704	3,717	--	Italy 1,963; Belgium-Luxembourg 612; United Kingdom 569.
Nonrefractory	292	2,077	16	Belgium-Luxembourg 1,284; Malawi 350; Seychelles 180.
Diamond:				
Gem, not set or strung value, thousands	$785,633	$981,453	$708,843	Belgium-Luxembourg $163,318; Hong Kong $73,618.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond —Continued				
Industrial ____ value, thousands__	$49,656	$68,610	$50,913	West Germany $6,824; Japan $5,406; Spain $1,641.
Feldspar and fluorspar:				
Feldspar _____	[2]2,712	[2]3,266	NA	NA.
Fluorspar _____	[2]384,387	[2]471,498	NA	NA.
Total _____	387,099	474,764	221,066	Japan 117,509; West Germany 55,287; Canada 25,471.
Fertilizer materials:				
Crude:				
Nitrogenous _____	443	15	--	All to Italy.
Phosphatic _____	--	65,511	--	Venezuela 65,260.
Manufactured:				
Nitrogenous _____	29,086	71,072	--	Malawi 38,629; Sri Lanka 30,900.
Phosphatic _____	7,278	18,811	--	Malawi 11,828; West Germany 6,536.
Potassic _____	200	1,929	--	All to Malawi.
Other including mixed _____	596	6,526	--	All to Sri Lanka.
Graphite, natural _____	842	359	--	United Kingdom 181; Taiwan 106; France 72.
Gypsum _____	[2]3,654	[2]3,237	NA	NA.
Kyanite and related materials _____	[2]54,457	[2]69,810	--	West Germany 16,872; Japan 13,040.
Lime _____	[2]25,215	[2]77,071	NA	NA.
Magnesite _____	501	13	--	Canada 8; New Zealand 5.
Mica, crude including splittings and waste _____	3,049	2,414	--	United Kingdom 1,460; West Germany 444.
Pigments, mineral: Processed iron oxides	[2]736	[2]696	NA	NA.
Precious and semiprecious stones except diamond:				
Natural ____ value, thousands__	$8,295	$29,424	$4,579	Switzerland $17,707; West Germany $2,526; Spain $1,788.
Synthetic _____ do____	$58	$48	--	West Germany $32; Philippines $10.
Pyrite, unroasted (sulfur content) ____	[2]17,236	[2]2,463	NA	NA.
Salt _____	[2]38,260	[2]53,612	--	Malawi 10,199; Seychelles 233.
Sodium and potassium compounds, n.e.s.:				
Caustic soda _____	12	102	--	Sri Lanka 99.
Caustic potash _____	--	21	--	Sudan 11; Spain 10.
Soda ash _____	NA	1,949	--	All to Israel.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked ____	[2]198,513	[2]191,530	3,491	Japan 75,704; France 72,284; Italy 68,235.
Worked _____	[2]6,705	[2]10,172	--	United Kingdom 1,216; Belgium-Luxembourg 960.
Gravel and crushed rock _____	1,767	1,225	280	United Kingdom 734; Italy 211.
Limestone except dimension _____	[2]19,073	[2]11,681	NA	NA.
Quartz and quartzite _____	[2]1,321	[2]1,540	NA	NA.
Sand:				
Silica _____	[2]685	[2]757	NA	NA.
Other _____	37,257	32,353	102	Netherlands 28,162; Belgium-Luxembourg 3,308.
Sulfur, elemental, colloidal _____	5	361	--	All to Malawi.
Talc and related materials: Pyrophyllite (wonderstone) _____	[2]6,837	[2]6,353	NA	NA.
Vermiculite _____	[2]186,665	[2]171,991	NA	NA.
Other: Slag, dross, and similar waste, not metal-bearing _____	36,904	71,244	--	France 26,056; Japan 23,416; United Kingdom 21,772.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black _____	2,643	2,329	--	United Kingdom 2,185.
Coal and briquets:				
Anthracite and bituminous coal thousand tons__	[2]15,389	[2]23,341	999	France 8,117; Italy 2,325; Japan 2,265.
Briquets of anthracite and bituminous coal _____	--	106,515	--	Republic of Korea 105,465.
Lignite including briquets _____	--	25,591	--	All to West Germany.
Peat including briquets and litter ____	29	15	15	
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels__	972	840	--	Australia 397; Malawi 351; New Zealand 92.

See footnotes at end of table.

Table 2.—Republic of South Africa: Apparent exports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products —Continued				
Kerosine thousand 42-gallon barrels	103	147	--	Malawi 123; New Zealand 24.
Distillate fuel oil ---do---	506	503	--	Malawi 502.
Residual fuel oil ---do---	1,501	253	--	Austalia 187; Italy 43; Malawi 22.
Lubricants ---do---	80	55	--	Malawi 44; Reunion 7.
Other:				
Liquefied petroleum gas ---do---	10	373	333	Reunion 37.
Mineral jelly and wax ---do---	264	245	79	Malawi 60; West Germany 50.
Petroleum coke ---do---	6	1	--	Mainly to Netherlands.
Bitumen and other residues ---do---	39	61	--	Reunion 60.
Bituminous mixtures ---do---	--	1	--	Mainly to Seychelles.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	6,851	5,926	10	United Kingdom 4,018; Brazil 1,753.

NA Not available.

[1]Because official South African trade statistics provide data only on the value of total exports of each commodity class (with no data on destinations) and not on quantity of material exported, this table has been compiled from a variety of sources including the quarterly publication "Minerals" issued by the Department of Mines (issues for 1978 and 1979) as well as official trade returns of trading partner countries. Data from the "Minerals" is footnoted; other figures are compiled from a variety of sources with specifics on destination obtained from the import statistics of the countries listed.

[2]Source: "Minerals" quarterly of the South African Department of Mines. Figures represent shipments by producers for export and not actual exports.

[3]May include platinum-group metals.

Table 3.—Republic of South Africa: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	18,199	23,699	--	Australia 18,799; Denmark 4,791.
Oxides and hydroxides	184,956	174,109	477	Australia 164,245; Japan 3,437; United Kingdom 3,384.
Metal including alloys:				
Scrap	518	405	143	West Germany 119; Australia 48; United Kingdom 27.
Unwrought	614	620	32	United Kingdom 198; West Germany 99; Netherlands 39.
Semimanufactures	7,355	7,166	1,854	West Germany 2,730; Japan 626; United Kingdom 449.
Arsenic:				
Trioxide, pentoxide, acid	r59	36	NA	NA.
Metal including alloys, all forms	17	10	--	All from Sweden.
Chromium:				
Chromite	1,348	845	NA	Australia 30; Brazil 30; Spain 25.
Oxides and hydroxides	319	445	44	West Germany 248; U.S.S.R. 58; United Kingdom 50.
Cobalt:				
Oxides and hydroxides	8	8	1	Australia 1; Belgium 1.
Metal including alloys, all forms	139	64	14	Belgium 28; Canada 10; United Kingdom 6.
Copper:				
Ore and concentrate value	$83	$158	NA	NA.
Metal including alloys:				
Scrap	210	55	NA	NA.
Unwrought	r1,078	2,127	NA	United Kingdom 134; Netherlands 61.
Semimanufactures	r1,910	2,528	182	West Germany 1,040; United Kingdom 468; Japan 196.
Gold:				
Waste and sweepings value	$13,417	$25,183	NA	NA.
Metal, including alloys, unwrought and partly wrought troy ounces	2,757	7,741	NA	West Germany 446; Switzerland 89.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel:				
Ore and concentrate	NA	79	NA	NA.
Metal:				
Scrap	16,769	7,910	NA	Greece 549.
Pig iron, ferroalloys, similar materials	7,774	38,456	266	Sweden 2,487; Brazil 792; France 502.
Steel, primary forms	10,085	5,839	NA	West Germany 697; United Kingdom 377; Austria 158.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r17,023	23,729	577	United Kingdom 6,471; West Germany 1,867; Japan 1,799.
Universals, plates, sheets	r50,767	39,436	666	Japan 15,052; West Germany 11,364.
Hoop and strip	10,371	10,094	585	Japan 3,389; United Kingdom 1,777; West Germany 1,737.
Rails and accessories	1,067	1,049	NA	NA.
Wire	20,120	20,187	60	Belgium 2,575; Italy 1,460; France 834.
Tubes, pipes, fittings	r36,604	43,804	2,264	Japan 23,602; West Germany 3,993; United Kingdom 3,260.
Castings and forgings, rough	r505	437	NA	West Germany 96; Belgium 29; Austria 28.
Lead:				
Oxides	19	25	NA	NA.
Metal including alloys:				
Scrap	29,699	31,517	27,639	United Kingdom 598; Sri Lanka 481; Australia 467.
Unwrought	5,662	3,365	NA	Belgium 400; Sri Lanka 91; United Kingdom 69.
Semimanufactures	30	32	NA	United Kingdom 18.
Magnesium metal including alloys, all forms	566	919	674	France 188.
Manganese:				
Ore and concentrate	3,339	2,984	NA	Brazil 2,660; United Kingdom 191.
Oxides	3,739	3,486	NA	Belgium 3,152; Greece 280.
Mercury 76-pound flasks	2,086	1,532	41	Netherlands 470; West Germany 249; Canada 220.
Molybdenum metal including alloys, all forms	17	32	13	Brazil 11; United Kingdom 7.
Nickel metal including alloys, all forms	4,204	1,729	107	Japan 452; West Germany 118.
Platinum-group metals including alloys, unwrought and partly wrought troy ounces	21,552	27,653	NA	West Germany 15,185; United Kingdom 7,269.
Silicon, elemental	78	111	4	France 95; United Kingdom 11.
Silver:				
Waste and sweepings[1] value	$429,564	$618,710	NA	Italy $333,782; West Germany $271,630.
Metal including alloys, unwrought and partly wrought troy ounces	968,367	745,822	1,794	United Kingdom 258,937; West Germany 219,391; Australia 176,163.
Tin metal including alloys:				
Scrap	380	611	NA	NA.
Unwrought	450	386	NA	United Kingdom 16; West Germany 15; Switzerland 10.
Semimanufactures	12	9	NA	West Germany 5; United Kingdom 1.
Titanium:				
Ore and concentrate	24	14	NA	NA.
Oxides	504	356	58	West Germany 168; United Kingdom 104.
Tungsten:				
Ore and concentrate	508	333	NA	Australia 30; Brazil 30; Spain 25.
Metal including alloys, all forms	142	201	5	Ireland 55; Portugal 30; Sweden 30.
Zinc:				
Ore and concentrate	4,196	2	NA	NA.
Oxides and peroxides	493	360	NA	West Germany 220; United Kingdom 87; Belgium 40.
Metal including alloys:				
Scrap	167	218	NA	Israel 137.
Unwrought kilograms	11,400	300	NA	NA.
Semimanufactures	21	15	NA	West Germany 9.
Zirconium ore and concentrate	91	33	NA	NA.
Other:				
Ores and concentrates:				
Of molybdenum, tantalum, vanadium	446	144	118	Canada 26.
Of other base metals	467	37	NA	NA.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Other —Continued				
Ash and residue containing nonferrous metals	12,315	5,652	2,050	West Germany 719; Switzerland 529; Australia 351.
Oxides, hydroxides, peroxides	r1,038	911	238	United Kingdom 359; Belgium 93; West Germany 77.
Metals:				
Metalloids:				
Boron	80	20	NA	Mainly from United Kingdom.
Phosphorus	--	24	NA	Do.
Other	6	6	2	Japan 2; Netherlands 1.
Alkali, alkaline-earth, rare-earth metals	83	69	NA	Canada 23; United Kingdom 19; Brazil 13.
Pyrophoric alloys	r16	6	4	West Germany 2.
Base metals including alloys, all forms	r171	408	24	United Kingdom 282; West Germany 24; Netherlands 22.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	559	792	10	Greece 11; West Germany 4.
Dust and powder of precious and semiprecious stones, value	$257,990	$305,818	--	United Kingdom $281,956.
Grinding and polishing wheels and stones	350	398	42	West Germany 119; United Kingdom 72.
Asbestos, crude	15,151	18,203	22	Canada 1,000.
Barite and witherite	2,436	19,168	--	Spain 16,611; United Kingdom 824; West Germany 134.
Boron materials:				
Crude natural borates	1,222	2,298	593	United Kingdom 980; Netherlands 519; West Germany 170.
Oxide and acid	r760	548	69	France 414; Argentina 38.
Bromine	51	55	NA	Israel 48; West Germany 6.
Cement	59,549	91,053	NA	France 13,148; West Germany 2,029; United Kingdom 1,541.
Chalk	4,781	4,851	NA	France 2,317; Sweden 1,611; United Kingdom 577.
Clays and clay products:				
Crude clays	24,386	33,706	22,309	United Kingdom 10,074.
Products:				
Refractory including nonclay brick	r31,455	27,768	1,585	West Germany 10,478; Ireland 4,522; Austria 2,894.
Nonrefractory	r2,054	5,319	NA	Mainly from Italy.
Cryolite and chiolite	152	111	--	Denmark 84; West Germany 27.
Diamond:				
Gem, not set or strung, carats	73,500	107,000	1,000	Belgium 38,500; United Kingdom 17,000; Switzerland 15,500.
Industrial, do	763,000	1,691,000	63,000	United Kingdom 944,500; Ireland 202,000.
Diatomite and other infusorial earth	7,728	5,900	5,381	Denmark 75; West Germany 39.
Feldspar and fluorspar	40	89	NA	NA.
Fertilizer materials:				
Crude:				
Phosphatic	4	7	NA	NA.
Potassic	153,627	42,901	--	Israel 14,175; Canada 13,264; West Germany 7,919.
Other including mixed	13	209	NA	NA.
Manufactured:				
Nitrogenous	r5,925	31,048	54	West Germany 25,868; France 1,978.
Phosphatic	34,678	111	--	Israel 72; United Kingdom 36.
Potassic	111,244	158,467	NA	Israel 61,875; Canada 40,997; West Germany 33,305.
Other including mixed	631	1,277	--	Netherlands 548; United Kingdom 506; Belgium 216.
Ammonia	3	21,026	2,000	U.S.S.R. 8,525; Venezuela 8,000.
Graphite, natural	520	938	NA	Norway 194; Sri Lanka 110.
Gypsum and plaster	5,216	5,939	14	West Germany 3,684; United Kingdom 1,200; Spain 1,039.
Lime	4,420	4,008	NA	Mainly from France.
Lithium minerals, crude	9,262	4,452	NA	NA.
Magnesite	83,792	124,827	198	Greece 28,979; Italy 12,043; Japan 8,958.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica:				
Crude including splittings and waste	567	685	NA	NA.
Worked including agglomerated splittings	44	65	21	United Kingdom 16; Belgium 14.
Pigments, mineral:				
Natural, crude	r21	36	NA	NA.
Iron oxides, processed	3,875	7,692	20	West Germany 5,009; United Kingdom 649.
Precious and semiprecious stones except diamond:				
Natural value, thousands	r$918	$1,178	$91	Switzerland $168; West Germany $122.
Manufactured do	r$1,592	$1,744	$74	Ireland $178; Taiwan $54; Switzerland $50.
Pyrite (gross weight)	53	904	29	West Germany 30.
Salt and brines	5,142	23,413	NA	Brazil 10,672; Australia 10,402.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	12,800	6,294	NA	United Kingdom 340; West Germany 228.
Caustic potash	r2,016	1,814	NA	France 1,044; Spain 496.
Soda ash	149,295	176,007	85,867	United Kingdom 54,664; Bulgaria 23,820.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	615	535	NA	Italy 353; Israel 68; Portugal 57.
Worked	669	608	NA	Italy 393; Portugal 95.
Dolomite, chiefly refractory-grade	1	1	NA	NA.
Gravel and crushed rock	3,768	2,153	NA	France 289; United Kingdom 83.
Limestone except dimension	56	55	NA	NA.
Quartz and quartzite	34	669	NA	NA.
Sand excluding metal-bearing	350	367	NA	West Germany 149.
Sulfur:				
Elemental:				
Colloidal	1,250	1,308	1,234	West Germany 42; United Kingdom 30.
Other than colloidal	638,411	811,730	79,043	Canada 700,427.
Sulfuric acid, oleum	62,102	146,703	6,986	West Germany 49,562; Belgium 35,328; Brazil 28,642.
Talc, steatite, soapstone	r1,746	1,819	246	Republic of Korea 790; Italy 273; Norway 169.
Other:				
Crude	r3,837	6,647	22	Greece 5,904; Austria 426; Australia 200.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	3,004	37	NA	NA.
Other	1,625	2,543	182	France 160; Taiwan 96; Italy 40.
Oxides, hydroxides, peroxides:				
Of strontium	--	6	3	NA.
Of magnesium	95	698	45	Israel 558; United Kingdom 77.
Of barium	81	84	NA	France 30; Spain 23; Italy 21.
Iodine and fluorine	11	23	3	Japan 18.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	1,040	1,057	279	Austria 368; Japan 125.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	604	946	336	Belgium 129.
Carbon black	2,825	3,183	686	Canada 609; United Kingdom 602; France 574.
Coal, all grades including briquets	198,593	175,887	NA	West Germany 2,475.
Coke and semicoke	4	8	NA	NA.
Hydrogen, helium, rare gases	23	39	31	West Germany 5.
Peat including briquets and litter	316	342	NA	Finland 115; West Germany 98; Ireland 71.
Petroleum refinery products:				
Lubricants 42-gallon barrels	6,773	9,300	3,480	United Kingdom 3,210; West Germany 1,987.
Liquefied petroleum gas do	326	363	87	France 232.
Mineral jelly and wax do	354,304	388,315	50,197	Japan 129,009; West Germany 89,105.
Pitch and pitch coke do	r970	5,849	5,584	NA.
Petroleum coke do	r223,461	311,583	221,060	United Kingdom 90,523.
Bitumen and other residue do	r3,171	1,594	1,111	NA.
Bituminous mixtures do	r3,049	2,211	962	United Kingdom 388; West Germany 365.

See footnotes at end of table.

Table 3.—Republic of South Africa: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	29	18	NA	NA.

[r]Revised. NA Not available.
[1]May include platinum-group metals.

Table 4.—Republic of South Africa: Value of domestic sales and exports of major mineral commodities

(Thousand U.S. dollars)

Commodity	Domestic sales			Exports		
	1978	1979	1980	1978	1979	1980
METALS						
Aluminum	81,000	NA	NA	26,910	54,120	NA
Antimony	9,269	11,601	13,534	3,244	14,146	4,119
Chromite	31,357	44,181	51,717	70,354	61,957	65,095
Copper	72,398	123,328	193,877	169,442	227,097	191,235
Gold[1]	NA	NA	NA	4,485,038	6,951,983	13,329,098
Hematite	57,357	78,355	129,391	188,946	262,995	243,992
Lead concentrate	--	--	--	--	--	41,493
Magnetite	5,536	8,307	7,277	856	--	--
Manganese	31,644	54,124	46,983	100,377	153,715	140,025
Nickel	15,199	11,265	14,949	87,630	39,234	68,981
Silver	16,899	35,548	65,720	--	--	--
Tin	8,740	10,958	26,712	25,729	23,983	22,678
Titanium	--	3,844	5,739	--	8,359	11,973
Uranium[1]	NA	NA	NA	244,953	303,057	e415,000
Vanadium	39	47	e50	61,180	77,369	e80,000
Zinc	12,346	14,076	18,180	4,811	5,768	3,747
NONMETALS						
Andalusite	4,444	6,492	8,872	5,852	7,953	13,888
Asbestos	6,570	6,861	11,718	123,595	120,526	119,582
Cement	166,188	257,814	e280,000	34,500	33,796	e35,000
Flint clay	2,342	2,683	4,911	4,368	5,295	5,991
Other clays	6,522	7,994	10,916	50	50	84
Diamond[1]	--	--	--	512,656	651,373	710,882
Feldspar	1,897	2,078	3,017	302	321	289
Fluorspar	2,020	2,559	3,284	24,789	33,402	43,855
Granite	808	1,387	1,850	17,158	18,617	22,201
Gypsum	2,224	2,655	4,048	30	26	12
Lime products	51,431	62,456	106,112	1,251	2,357	2,697
Limestone	38,252	46,209	43,531	160	165	690
Magnesite	1,398	3,122	3,204	--	--	--
Mica	122	227	384	552	416	568
Phosphate rock	58,728	74,574	88,760	--	--	106
Pyrite-sulfur	9,070	10,044	29,897	637	98	2,072
Salt	11,300	13,938	16,123	1,020	1,825	1,928
Silica, sand	9,575	14,873	21,362	136	188	393
Sillimanite	236	808	826	1,726	2,537	2,989
Slate	1,055	1,127	2,003	1,153	1,890	2,918
Other stone	524	713	1,227	676	808	561
Vermiculite	217	222	287	8,393	8,229	9,993
Wonderstone	319	323	243	872	1,536	654
Miscellaneous	1,179	1,319	1,927	1,113	1,723	1,663
MINERAL FUELS						
Anthracite	14,648	23,599	29,664	63,733	93,736	129,343
Bituminous coal	617,144	731,202	1,007,560	310,090	512,077	755,126
Carbon black	8,395	8,925	e9,000	--	--	--
Total	1,358,392	1,679,848	2,264,855	6,584,282	9,682,727	16,480,921

[e]Estimated. NA Not available.
[1]Value, if any, is included under "Exports."

Sources: Republic of South Africa Department of Mines, Quarterly Information Circular, Minerals, October-December 1979, Commodity Summaries for Monthly and Annual Periods, 1980. U.S. Consulate, Johannesburg, Republic of South Africa. State Department Airgrams A-56, July 31, 1979, Appendix C, and A-47, July 15, 1980, Appendix C.

COMMODITY REVIEW

METALS

Aluminum.—Alusaf (Pty.) Ltd. continued to import alumina from the Alusuisse operation in Gove, Australia, to its refinery at Richards Bay, and produced 82,500 tons of liquid metal and ingots in 1980 for its affiliated fabricators. Alusaf was owned 66% by the IDC, 22% by Alusuisse, 8% by Barlow Rand Ltd., 3% by Huletts Aluminum Ltd. (Hulamin), and 1% by Alcan Aluminum Ltd. The adjacent Alustang (Pty.) Ltd. factory produced redraw rods and solid sector aluminum for electrical cable, and Hulamin produced flat and coil sheet, extrusions, cable, and aluminum paste for the paint industry at its four plants. Hulamin announced it was adding a third foil mill to its holdings. The mill was to cost $11.5 million and was scheduled to be on-stream in 1982. Alusaf announced that it was to purchase another 86,000-ton-per-year smelter from Nippon Light Metal Co. of Japan and was to install it at Richards Bay at a total cost of $296 million. The South African Marine Corp. (Pty.) Ltd., also a Government enterprise, was awarded the $9.6 million contract to transport the relatively new plant starting early in 1981. Commissioning at its Richards Bay site was scheduled to start early in 1982, and full production was to be achieved the following year. Alusaf was also investigating the local production of carbon anodes utilizing coal and waste gases from the Triomf fertilizer complex also at Richards Bay.

Antimony.—All of the Republic's antimony came from a series of mines along the "antimony line" of the Murchison Range west and northwest of the Palabora copper mine. The mines were owned and managed by Consolidated Murchison Ltd. (CML), reportedly the world's largest antimony producer, owned 25% by Johannesburg Consolidated Investment Co. Ltd. (JCI). Production of cobbed ore and concentrate totaled about 22,000 tons in 1980, 11% more than that of 1979. CML exported 3,000 tons of the product at an average value of $1,360 per ton. Local sales of 12,000 tons at an average price of $1,127 per ton were made to Antimony Products (Pty.) Ltd. (APL), which was jointly owned by CML, JCI, and the McGean Chemical Corp. of Cleveland, Ohio, successor to Chemetron Corp. of Chicago. APL manufactured an antimony oxide fire retardant at its factory built on CML property at Gravelotte in Transvaal. The factory was recently expanded to treat about 80% of CML's annual production of concentrate. CML has improved its concentrating facilities and has installed a plant to treat and recover byproduct gold from the slag discharged by the APL factory.

Chromium and Chromite.—There was a 4% volume increase in the country's production of the chromium-iron oxide mineral chromite in 1980. Coincidentally, both the volume and the domestic value of chromite exports diminished by 4% each, but the value of local sales increased 8% in terms of domestic currency and 17% in U.S. dollar equivalents. Total sales value declined but sales value equivalent increased 10% to $116 million. As in previous years, slightly less than half of the total sales was exported, and most of the domestic consumption was by the ferrochromium industry, although refractory and chemical uses accounted for a significant share of the output. All of the country's chromite came from some 17 mines operating along parallel seams in noritic rock of the Bushveld Igneous Complex of central Transvaal Province. Except for the Grasvally and nearby mines in the northern part of the complex, the chrome-to-iron ratio was low, less than 2.3 to 1, and an increasing amount of high-carbon, high-iron ferrochromium was produced for export sales. Much of the export ore was shipped through the port of Matola, near Maputo in Mozambique.

The country's largest producer of chromite was the General Mining and Finance Corp. Ltd., which was merged to form the General Mining Union Corp. Group (Gencor). Gencor's Montrose and Groothoek Mines in eastern Transvaal and the Zwartkop and Kroondal Mines in the Rustenburg district of western Transvaal produced more than 1 million tons of chromite and were not operating at full capacity because of the oversupply of chromite during the past 3 years.

Barlow Rand announced the installation of load-haul-dump machines, operating between the working face and the underground conveyor belts, to replace scraper and hand loading at its Millsell Mine near Rustenburg. A heavy-medium separation plant was being installed at Millsell's concentrator. A similar plant was scheduled for the Elandsdrift section of Barlow Rand's

Henry Gould Chrome Mine, 30 kilometers east of Millsell, and improvements were also in progress in the concentrator at the Buffelsfontein section.

One of the country's smaller chromite producers was the Bantu Mining Corp., which exported some 15,000 tons of chromite from its Dilokong Mine in the Lebowa Homeland north of Steelport.

Texasgulf Inc. was considering the investment of some $350 million to establish a mining complex near Brits in Transvaal on the UG2 chromatite unit of the Bushveld Igneous Complex, which contains both chromite and platinum but very little nickel. Texasgulf's Expanded Precessive Plasma (EPP) process was expected to achieve good recoveries of both chromium and platinum.

Copper.—Production of copper in the Republic of South Africa increased more than 5% in 1980 but the volume of exports declined 15% and their value dropped 22% in terms of domestic currency, reflecting the depressed state of the world's copper industry and price. Most of the increase in copper production was due to the startup by GFSA and Phelps-Dodge Corp. of the Black Mountain lead-zinc-copper-silver mine in northwestern Cape Province in mid-1980. The Black Mountain Mine near Aggeneys, 200 kilometers northeast of Springbok, was reported to have operated at nearly full capacity for half of 1980. This indicated the production of some 8,000 tons of concentrate containing about 22.5% copper and a substantial quantity of silver plus minor amounts of lead and zinc impurities. The copper concentrate was exported from the new base-metal terminal at Saldanha Bay.

Rio Tinto-Zinc Corp. Ltd.'s (RTZ) Palabora Mining Co. Ltd. (PMC) initiated plans to expand its open pit and to maintain its production rate at more than 30 million tons of ore and 125,000 tons of finished copper per year. PMC installed trolley lines over the main haulage ramps out of the pit and equipped the trucks with dual diesel-electric power sources and pantograph-type trolley pickups. This arrangement was designed to conserve scarce diesel fuel but it also saved time as well as vehicle maintenance because the electric drive allowed greater truck speeds, and the diesel motors were never driven under heavy-load top-speed conditions. PMC also was to install a 2,700-ton-per-hour crusher, equipped with a walking mechanism for mobility, to crush low-grade foskorite for subsequent treatment by Foskor. PMC was also the world's largest producer and exporter of vermiculite, and its other byproducts included uranium oxide, zirconia (baddeleyite), precious metals, and magnetite.

The O'okiep Copper Co. Ltd., owned 57.5% by Newmont Mining Corp. and 14.4% by AMAX Inc., ended 1980 by closing the small Brandkloof, Koperberg, and Rietberg Mines near Springbok in northwest Cape Province because of low copper prices and depleted ore reserves. Its Spektakel Mine, 30 miles west of Nababeep, was started up in November 1980 in order to avoid a shortfall of ore to the mills. The old O'okiep mill, idle since 1975, was previously dismantled and rebuilt at the Spektakel Mine site for this purpose. O'okiep's Carolusberg mill was still functioning as were the mill and smelter at Nababeep. The latter produced 32,000 tons of blister copper from O'okiep's concentrate and from concentrate from the Prieska copper mine at Copperton, 425 kilometers to the east. O'okiep was planning to mine deep mineralization at Carolusberg where shaft-sinking started late in 1979. Diamond drilling indicated that the upper part of the Carolusberg Deep ore body contained 15.7 million tons of 2.05% copper ore and continued downdip. Production from this section was expected to commence in 1983. Anglo Transvaal Consolidated Investment Co. Ltd.'s (Anglovaal) Prieska Copper Mines (Pty.) Ltd. reported that encouraging mineralization had been located, but not delineated on the south limb of the main ore body. The Messina Transvaal Development Co. Ltd. operation in northern Transvaal continued to struggle with the problems of low copper prices and diminishing ore reserves.

Gold.—The gold industry of the Republic of South Africa set new records in terms of ore produced (90 million tons) and sales value of gold (R10.369 billion=US$13.3 billion), although gold production declined more than 4% to 21.67 million troy ounces, the lowest since 1960 when production was 21.38 million troy ounces. The average sales price rose from $307 to $616 per troy ounce, and an alltime high of $850 per troy ounce was recorded in January 1980. Details of production of the major mines or companies and their ore reserves are shown in table 5. Two of these mines produced more than the 1.552 million troy ounces produced by Canada, the world's third largest producer of gold. Five others produced more than the 1.3 million troy ounces from fourth place Brazil, and four others outproduced fifth

place United States with 951,384 troy ounces.

The Republic's 36 larger gold mines produced 89.92 million tons of ore in 1980 at an average grade of 0.234 troy ounce per ton. These 36 mines and 2 major tailings retreatment plants were responsible for most of the country's gold output. All but one were controlled or managed by seven large corporations, reduced to six during 1980 by the merger of two of them to form the Gencor Group. The others were Anglo American Corp. of South Africa, Ltd. (AAC), Anglovaal, Barlow Rand, GFSA, and JCI. Each of the major mines continued to produce its own gold bullion containing about 88% gold, 10% silver, and 2% base metals in bars weighing about 835 troy ounces. The bars were delivered to the Rand Refinery Ltd. at Germiston where they were assayed and purchased on behalf of the South African Government's Reserve Bank. The Rand Refinery continued to be the world's largest gold refinery with a capacity of 100 tons of silver and 1,000 tons of gold per year.

Approximately 107 tons of the country's gold production was minted into coins at the South African Mint in Pretoria and sold throughout the world by the International Gold Corp. (Intergold) on behalf of the Chamber of Mines of South Africa. In September 1980, Intergold introduced three smaller coins of the Krugerrand family exactly like the 1-ounce parent coin except for the denominations 1/2, 1/4, and 1/10 troy ounce. At yearend, Intergold reported sales of 2,845,872 of the 1-ounce Krugerrands, 245,096 of the 1/2-ounce, 353,916 of the 1/4-ounce, and 856,011 of the 1/10-ounce coins, as well as 168,000 2-Rand and 92,600 1-Rand gold coins during 1980.

Most of the more recent plans for expansion of the country's gold mines were formulated as extensions of successful operations in order to offset the capital expenditure involved against their profits for tax purposes. This was only possible where the new properties involved were contiguous, but in such cases the state effectively contributed 60% of the cost. Such a proposed merger involved two of GFSA's richest mines. The West Driefontein, which produced 2.7 million tons of ore at a grade of 0.521 troy ounce per ton in 1980, and the East Driefontein with 2.6 million tons of 0.486 troy ounce per ton of ore, had a total output of 2.67 million troy ounces or more than 83 tons of gold worth nearly $1.7 billion in 1980. In the North Driefontein area between the two mines, reserves of 27 million tons of ore with 0.46 troy ounce per ton were to be extracted with the expenditure of minimal capital on two service shafts and a moderate amount of underground development to facilitate access and ore handling, and to provide ventilation. The combined operation was to qualify as the world's largest gold mine on the basis of gold output.

The new GFSA Deelkraal concentrator commenced operations at an initial rate of 60,000 tons per month of ore in January 1980, following trial operations the preceeding month. Underground development was accomplished from twin production shafts 142 meters apart on the surface. The project was started in 1974 entirely on the evidence of drillhole information and was under budget after an expenditure of $174 million by the first of the year. Substantial savings were realized by the purchase of all basic equipment for mine and infrastructure early and storing it until needed. Both reduction works and housing were erected well ahead of the date required. The No. 2 shaft and its subvertical extension were continued to a depth of 2,419 meters and plans involved a tertiary shaft system to 3,403 meters. Ventilation was provided by two 2,610-kilowatt fans on the 58.1-square-meter downcast area of the No. 1 shaft. Two similar fans operated on the 42-square-meter upcast area of the No. 2 shaft. Two 3,300-kilovolt refrigeration units at the surface provided service water at 6° C, but their capacity was only 25% of that required when more extensive underground development had been achieved.

The primary crusher was a slipper-bearing autogenous mill 4.85 meters in diameter and 11.15 meters long. The grinding capacity for autogenous operation had been rated as 75,000 tons per month, but this was not achieved because of an excessive number of large rocks in the ore feed. As a temporary measure, these were extracted and stockpiled pending installation of a jaw crusher in mid-1981.

In mid-1980, GFSA's Doornfontein Mine was reclassified as an "other deep level gold mine," which entitled it to a 10% allowance on capital expenditure for a 10-year period. It was also granted a new, less onerous, lease from the Government. Both arrangements were retrospective to July 1, 1979. Doornfontein applied for and was granted a mining lease over ground held by GFSA which contained the downdip extensions of

the Doornfontein ore body. GFSA received the rand equivalent of $1.25 million as option consideration and agreed to subscribe for 172,000 new Doornfontein shares. Development work on two subshafts was started prior to the granting of the new lease and subsequently a new No. 2 shaft was started from surface. Erection of the headgear was nearly completed and construction of the shaft buildings and installation of the man hoist were in progress at yearend.

Barlow Rand's East Rand Proprietary Mine was planning to expand its scale of operations by August 1980. After a year of record-breaking profits ($197.7 million in 1980), it announced plans to expend some $385 million during the next 5 years to achieve a major extension in the life of the mine. About $300 million was to be spent on additional surface, subvertical, and tertiary shafts that would allow mining to progress below the present depth of 3,458 meters to approximately 4,250 meters. The necessary refrigeration system for mining at this depth was estimated to consume 85 megawatts of power. Approximately $75 million was scheduled for housing and facilities for additional staff and $10 million for surface plant, including an administration building.

During 1980, Union Corp. Ltd. became a wholly owned subsidiary of Gencor. The new Unisel Mine, brought into production in 1979 by Union Corp., continued to have its 920,000 tons of gold ore treated in St. Helena's concentrator on a toll-fee basis, and reported a working profit of more than $80 per ton. At the new Beisa uranium-gold mine, excessive water hampered shaft sinking but construction of surface buildings was proceeding satisfactorily, including both the uranium and gold extraction plants. The latter was the first Witwatersrand plant to use the carbon-in-pulp gold extraction process on a large scale. The gold was collected on small fragments of charcoal made from coconut shells. The cost of the 75,000-ton-per-month plant was estimated at $2.6 million. Gencor was also commencing the expenditure of about $412 million for commissioning by 1985 the Beatrix gold mine south of Unisel, near Welkom in Orange Free State.

AAC's Vaal Reefs Mine earned the title of the world's largest underground gold mine because it hoisted and milled 8.4 million tons of ore and produced therefrom nearly 2.25 million troy ounces of gold worth more than $1.4 billion. It also became the first mine to earn more than $1.0 billion in gold revenue in 1 year. Its working profit was $122 per ton of ore, but this was surpassed by 10 mines including AAC's Western Deep Levels Mine, which earned $225 per ton, and by GFSA's Kloof, East Driefontein, and West Driefontein Mines, which earned $234, $260, and $275 per ton of ore, respectively. Vaal Reefs' achievements were attributed to improved safety and working conditions resulting from increased refrigeration capacity, better training, and more efficient use of computers in personnel work, administration, and plant management.

AAC proposed to combine their Free State Saaiplaas, Welkom, and Western Holdings operations with the low-grade mineralization underlying the adjacent Erfdeel and Dankbaarheid properties immediately north of Saaiplaas. The capital cost of the independent project was estimated at $514 million, but by merging and offsetting costs against profits, the after-tax cost would be about $129 million. Initial mining operations were expected to generate a portion of the necessary cash flow. The new ore deposit was expected to operate at 200,000 tons per month from an ore body of 62 million tons containing an average of 0.145 troy ounce per ton. The other partners produced nearly 1.44 million troy ounces of gold worth $883 million from 7.6 million tons of ore at an average grade of 0.190 troy ounce per ton in 1980.

AAC was also planning to expand its operations at Western Deep Levels to include adjacent territory with reserves of 63 million tons of ore containing 0.31 ounce per ton of gold plus indicated reserves of an additional 74.3 million tons with 0.195 ounce per ton. The costs of the contemplated twin-shaft system to a depth of 3,760 meters with new surface treatment and refrigeration plants, were estimated to total some $600 million by the commissioning date of early 1986. Nearly $400 million was estimated as the extra cost of a later subshaft system to bottom at 3,800 meters in 1992. It was also planned that a number of facilities such as a 23-kilowatt emergency power generator would be installed at both the Western Deep Levels plants and at the nearby Elandsrand Mine.

Table 5.—Republic of South Africa: Gold production and ore reserves, by producer

Producer	Production (troy ounces)			Developed ore	
	1978	1979	1980	Thousand metric tons	Troy ounces per metric ton
Anglo American Joint Metallurgical Scheme	46,940	62,800	73,824	NA	NA
Barberton	51,856	48,496	49,998	NA	NA
Blyvooruitzicht	628,242	605,363	580,302	5,020	0.711
Bracken	168,550	139,235	112,849	3,200	.170
Buffelsfontein	899,983	836,183	854,554	11,457	.331
Deelkraal	--	--	101,731	1,676	.181
Doornfontein	403,968	388,285	391,972	3,658	.373
Durban Deep	272,584	243,683	233,984	4,529	.186
East Driefontein	1,565,474	1,555,816	1,263,556	12,745	.518
East Rand Gold and Uranium (Ergo)	84,910	166,219	220,908	NA	NA
East Rand Proprietary Mine	337,917	345,373	378,491	6,832	.244
Elandsrand	--	94,240	168,804	988	.204
Free State Geduld	1,366,069	1,210,180	1,035,964	10,327	.430
Free State Saaiplaas	139,177	140,772	154,053	2,917	.162
Grootvlei	194,952	216,837	204,337	8,800	.117
Harmony	985,227	1,037,697	1,004,646	19,767	.238
Hartebeestfontein	1,014,751	1,023,213	1,032,679	13,242	.392
Kinross	361,815	309,599	293,205	7,600	.228
Kloof	850,281	1,008,334	972,390	3,765	.601
Leslie	137,184	129,066	118,035	3,000	.177
Libanon	430,701	400,431	347,161	4,166	.415
Loraine	229,235	197,714	171,743	5,876	.258
Marievale	87,029	58,926	43,989	210	.178
President Brand	977,637	985,719	955,469	11,458	.343
President Steyn	816,188	835,476	837,758	17,286	.286
Randfontein	678,577	755,079	669,272	5,832	.294
St. Helena	552,703	552,520	533,988	12,400	.328
Stilfontein	533,091	532,265	559,034	7,084	.292
Unisel	--	38,591	184,240	2,100	.219
Vaal Reefs	2,168,182	2,163,153	2,246,565	31,903	.357
Venterspost	211,578	199,611	190,554	2,709	.254
Welkom	420,368	393,538	365,004	8,523	.220
West Driefontein	1,840,797	1,679,992	1,407,952	5,402	.701
West Rand Consolidated	107,422	75,037	86,402	1,098	.133
Western Areas	745,370	742,971	628,676	11,561	.180
Western Deep Levels	1,467,913	1,539,689	1,466,743	6,176	.593
Western Holdings	1,044,520	997,101	918,074	12,583	.338
Winkelhaak	504,673	489,501	456,949	10,900	.244
Witwatersrand Nigel	36,176	37,137	33,112	1,400	.172
Other	286,518	380,814	320,501	NA	NA
Total or average	22,648,558	22,616,656	21,669,468	278,190	.324

NA Not available.

Sources: Chamber of Mines of South Africa. Quarterly Analysis of Working Results, October-December 1978, 1979, 1980. U.S. Consulate General. Johannesburg, Republic of South Africa. State Department Airgram A-47 of July 15, 1980, pp. 45-48.

Iron Ore and Concentrate.—Production of iron ore decreased 17% in 1980, largely because of reduced demand for the export of hematite, but the value of local sales increased slightly in terms of domestic currency and was reflected as a 9% increase in terms of U.S. dollars. The value of iron ore exports decreased 14% in local terms and 7% in terms of dollars. Japan and the Federal Republic of Germany continued as the principal customers of the country's iron ore with imports of 6.3 and 4.9 million tons, respectively, in 1980. The chief producer and exporter was the Sishen Mine in the arid northern Cape Province, operated by the Government-owned ISCOR. The highly automated Sishen-Saldanha Railway and the Saldanha Bay iron ore loading port with an export capacity of 18 million tons of hematite per year were operated by South African Railways and Harbours (SARAH). Sishen also produced the majority of the ore consumed in ISCOR's steel-producing plants at Vanderbijlpark in Transvaal and Newcastle in Natal Province. Sishen supplied 7,040,700 tons of hematite ore to ISCOR, 12,295,000 tons for export, and 196,000 tons to other local consumers in 1980. ISCOR's Thabazimbi Mine in Transvaal supplied 2,110,000 tons of hematite ore to its third steel plant at Pretoria.

At the Sishen Mine, 1,200-volt direct-current trolley lines were installed over the ramps leading from the pit, and the ore hauling trucks were equipped with pantograph trolley pickups in order to minimize consumption of scarce diesel fuel. The measure also saved time because the up-

grade speed of electrically driven trucks was 20 kilometers per hour instead of the 12-kilometer-per-hour speeds achieved under diesel power. Maintenance benefits also occurred because the diesel engines ran for shorter periods, at lower speeds, and never under full uphill load. Portable crusher units for overburden to be removed by shiftable conveyor bridges and belts were also installed as diesel fuel saving measures. The approximately 200 trucks of Sishen's ore trains were loaded at a rate of 4,000 tons per hour. The trains were 2.3 kilometers long, weighed some 20,000 tons, and traveled the 861 kilometers from Sishen to Saldanha Bay in about 19 hours at average speeds of 45 to 50 kilometers per hour.

Magnetite ore production continued as a byproduct of the carbonatite copper deposit mined by PMC in eastern Transvaal. AAC's Highveld Steel and Vanadium Corp. Ltd. produced 2.2 million tons of titaniferous, vanadiferous, magnetite ore from its Mapochs Mine near Roossenekal on the eastern limit of the Bushveld Igneous Complex.

Iron and Steel.—1980 was a banner year for ISCOR, which reported a profit of $197 million compared with a $45 million loss in 1979. The completion of costly technical improvements to all three of ISCOR's steel plants coincided with a 25% increase in the local demand for steel and produced a profit in a year when most of the world's steel industries experienced recession. Construction of the Sasol II and III oil-from-coal plants, the Koeberg nuclear power station, the Drakensburg dam and water diversion scheme, and a number of new mining and metallurgical plants contributed to the demand for steel, as did the extensive rehabilitation of the railway system throughout the Republic and in neighboring Mozambique. ISCOR's furnaces consumed 9.3 million tons of iron ore, 6.4 million tons of coking coal, and 1.4 million tons of dolomite in 1980, and the company sold 5.5 million tons of steel and nearly 200,000 tons of pig iron. Profits were enhanced by the sale of byproduct tar, creosote, benzole, and ammonium sulfate, the latter supplied to the fertilizer and explosives producing companies.

The Cape Town Iron and Steel Works (Pty.) Ltd., a subsidiary of ISCOR, authorized an Italian company, Danieli Engineering S.p.A., to plan a new electric steelworks near its 52,000-ton-per-year plant. The new plant was to have an initial capacity of 75,000 tons per year of billets, centered around a 25-ton electric arc furnace and a two-strand continuous billet caster.

Middelburg Steel and Alloys Ltd., a 71% subsidiary of Barlow Rand (18% AAC and 11% IDC and others), was spending $193 million to expand its Southern Cross Steel Co. (Pty.) Ltd. plant at Middelburg in Transvaal, from 23,000 to 63,000 tons per year of stainless steel by the end of 1981. Imported equipment included continuous casting facilities from Austria, a Steckel hot-strip mill from the United States, and a Zindzimer cold-strip mill from the United Kingdom. The capacity of the meltshop was to be increased to 200,000 tons per year. In late March 1980, the company announced the development of a new low-cost, corrosion-resistant steel named 3CR12. Consumption was expected to double the demand for chromium within a decade.

Specialty steels, stainless steel sheet, and steel products continued to be produced by AAC's Highveld Steel and Vanadium Corp. Its Vantra Div. at Witbank in Transvaal reported that a one-third increase in capacity was expected to come onstream in 1983.

Ferroalloys.—South African Manganese Amcor Ltd. (Samancor) continued as the country's and the world's first ranking producer of ferroalloys, as well as of manganese. Its ferromanganese capacity increased 300% in a decade to 580,000 tons per year and its ferrochromium capacity increased to 250,000 tons per year in 1980 from about 30,000 tons per year in the late 1960's. Samancor's Kookfontein ferromanganese plant, 30 kilometers south of Johannesburg, operated submerged arc electric furnaces, while its Newcastle plant in Natal was a blast furnace operation. Associated Manganese Mines of South Africa Ltd. (AMMOSAL) operated a submerged arc furnace at Cato Ridge, 50 kilometers from Durban in Natal. AAC had a similar operation at its Transalloy plant at Witbank in Transvaal and was the country's sole producer of medium-carbon ferromanganese.

Lead and Silver.—Until 1980, most of the Republic's silver (70 tons per year) was produced as a byproduct of the gold industry at the Rand Refinery at Germiston and at the refineries of the copper, zinc, and other industries. Most of its lead was imported from mining operations in neighboring countries, such as ISCOR's Rosh Pinah Mine in Namibia. At the end of 1979, the Nation's first predominantly lead-silver mine in the remote near-desert country of northwest Cape Province commenced a 6-

month period of commissioning and became fully operational by mid-1980. The Black Mountain Development Co. Ltd. (BMD), managed and 51% owned by GFSA with Phelps-Dodge holding 49%, commenced mining and milling the upper high-grade lens of its Broken Hill ore body. The approximate grades of the metals and their values in dollars per ton of ore were 9.6% lead ($80), 2.6% zinc ($20), 0.6% copper ($12), and 5.4 troy ounces of silver per ton ($80).

The computer-controlled concentrator was started in late 1979, and throughput was increased until full mining and milling capacity was achieved at the rate of 1,125,000 tons of ore per year. Recovery of the metal constituents was by selective flotation. The lead concentrate contained 72% lead representing a recovery of about 92% of the lead in the ore and 71% of its total silver. The copper concentrate was 22.5% copper and included approximately 75% of the ore's copper content and 18% of the ore's silver. The zinc concentrate averaged 52% zinc and included 65% of the zinc from the ore and less than 1% of its silver.

All three concentrates were trucked over a 166-kilometer road built by the Provincial administration to connect the mine with its storage and loading facility on the Sishen-Saldanha Railroad. Zinc concentrate was railed directly to the GFSA zinc refinery at Springs in Transvaal, operated by the Zinc Corp. of South Africa Ltd. (ZINCOR). Both lead and copper concentrates were railed to the new outloading quay in Saldanha Bay for shipment to overseas smelters. The first consignment of some 11,000 tons of lead concentrate arrived at Saldanha in March 1980, before the new quay's 15-ton cranes were installed, and was stored in a shed where it was loaded into 12-ton skips. The skips were loaded, two on each of several trailers, which were pulled by tractors the 2-kilometer distance to the ship's side on the quay. The 38,542-deadweight-ton bulk carrier La Costa used her two gantry cranes to lift the skips from the trailers and empty them into her holds.

The reserves of the Broken Hill ore body included 38 million tons of ore containing 6.35% lead, 2.87% zinc, 0.45% copper, and 2.7 troy ounces of silver per ton. BMD's long-range planning included future mining of its adjacent Black Mountain deposit, where provisional ore reserves of 80 million tons contained 2.7% lead, 0.6% zinc, and 0.7% copper, and its Big Syncline deposit, where 100 million tons of ore containing 1.0% lead and 2.5% zinc were delineated by drilling. BMD's infrastructure requirements included the provision of a self-sufficient township, which was located midway between Black Mountain and Gamsberg Mountain several kilometers to the northeast. The Gamsberg Zinc Corp. Ltd., owned jointly by Newmont South Africa Ltd., O'okiep Copper, and AAC, have partly developed a deposit of 152 million tons of predominantly zinc mineralization near Gamsberg.

Manganese.—Both the manganese ore mining and the ferromanganese industries had a poor year in 1980. Despite a 10% increase in the volume of ore produced, the volume of ore exported declined 18%, and its domestic value decreased 16% to the equivalent of $140 million, a drop of 9% in terms of U.S. dollars. Declining exports reflected the continued recession in the world's steel industry and the competitive nature of the manganese ore market. By yearend, only some 65% of the domestic production capacity was being utilized. Ten mines were responsible for most of the 5.7 million tons of manganese ore produced in 1980. They were all controlled by three large companies: Samancor (45% Government-owned), AMMOSAL, and AAC. All these operations were in the Postmasburg or Kalahari manganese fields in the northern part of Cape Province, and all shipped their ore some 950 kilometers to the old 6.5-million-ton-capacity iron ore outloading facilities at Port Elizabeth for export by freighter. The ore trains usually comprised 100 trucks and were as much as 1.7 kilometers in length.

Samancor was the world's largest producer of manganese ore and of ferroalloys, with enormous reserves of manganese estimated to last 600 years and sufficient chromite reserves to last a century. It established Samancor Metals and Minerals Inc. in the United States to handle sales in the Northern Hemisphere where it owned the European metal sales company Auvernier Ltd. as well as U.S. ferromanganese producer Roane Ltd. of Rockwood, Tenn.

Both Samancor and AMMOSAL were well established as manganese ore producers in the Postmasburg-Kalahari Field with three large underground room-and-pillar operations and six opencast mines that produced a total of nearly 4.5 million tons in 1980 at individual production rates ranging from 20,000 to 140,000 tons per month. The ore grades ranged from 28% to more than

50% manganese and the iron content ranged from 4.5% to 26%. Calcium and magnesium carbonates were the major impurities, and the ore was nearly free of deleterious contaminants with less than 0.05% phosphorous and 0.03% sulfur.

AAC's Middelplaats underground mine was one of the most highly mechanized base-metal mines in southern Africa but was operated at about 75% of its 1.1-million-ton-per-year planned capacity. Its low-phosphorus, calcareous manganese ores were a self-fluxing type suitable for blast or electric furnace operation and were largely exported to Japan and Western Europe.

Rand London Manganese Mines (Pty.) Ltd. operated eight small mines in Transvaal Province; its Ryedale Mine and its sister operation, the Brandvlei Mine, opened in March and July 1980, respectively, in the Ventersdorp district. The new mines had a capacity of 3,000 to 4,000 tons per month each of 35% to 40% MnO_2 (uranium-grade) ore. The company was the major supplier of manganese ore to the Republic's uranium industry. Rand's Gopane Mine produced 4,000 tons per year of battery-grade ore (more than 65% MnO_2) consumed by the dry-cell industry as well as lower grade ore. Rand's total production included about 400,000 tons per year of uranium-grade ore and 50,000 tons per year of chemical ores other than uranium-grade.

A $320,000 spray drying plant was under construction by Delta Manganese (Pty.) Ltd. of Nelspruit, part of Delta Metal Holdings Ltd., to speed up the production of manganese sulfate, which is used in numerous industrial applications, as a trace element additive to fertilizer, and in the chemical industry. Delta Metal also announced plans to install a $19 million plant to produce 20,000 tons per year of electrolytic manganese dioxide adjacent to its manganese metal facility at Nelspruit in eastern Transvaal. Delta Manganese was reportedly the world's largest producer of electrolytic manganese metal. Its capacity, combined with that of Electrolytic Manganese Corp., was reported as 42,000 tons of metal at yearend 1980.

Nickel, Platinum-Group Metals, and Cobalt.—Official figures regarding the volume of production, local consumption, and export sales of nickel, and all data about platinum-group metals were restricted from publication by the Government of South Africa. The values of nickel sold locally and exported were reported as the rand equivalents of nearly $15 million and $69 million, respectively. These represent increases of 33% and 63% over 1979 sales in terms of local currency. The total value of platinum-group metals imported by worldwide consumers was $792.7 million in 1979 and $887.3 million in 1980. Most of the country's output of these metals continued to come from the Merensky Reef in the Bushveld Igneous Complex. JCI's Rustenburg Platinum Holdings Ltd., the world's largest producer of platinum metal, was increasing the capacity of its associated Matthey Nickel's new $15.9 million refinery to 19,000 tons per year of electrolytic nickel as well as 400 tons per year of refined cobalt metal instead of the 500 tons per year of cobalt sulfate produced by the old plant in 1980. The platinum-group metals refinery at Wadesville was owned jointly with Johnson Matthey and Co., which was also sole marketing agents for the company. Rustenburg operated four mines near and northwest of the town of that name. Portions of the mines were in the Bophuthatswana Homeland.

Impala Platinum Mines (Pty.) Ltd. continued as the country's second largest producer, with the capacity for 750,000 troy ounces of platinum-group metals and 10,000 tons per year of nickel. Construction of a pilot plant for the recovery of cobalt was under consideration, but market trends toward the yearend were considered unfavorable. All four of Impala's mines were in the Bophuthatswana Homeland, as were the concentrator and smelter. Matte from the smelter was transported to Impala's nickel-copper and precious metal refineries at Springs in Transvaal Province for separation and purification.

Western Platinum Ltd., a subsidiary of Lonhro Ltd. of the United Kingdom, with Superior Oil Co. of the United States and Falconbridge Nickel Mines Ltd. of Canada, continued production of platiniferous matte at its mine and plant near Brits in Transvaal. The matte was shipped to the Falconbridge refinery in Norway where the precious metal fraction was separated and returned to Brakpan in Transvaal for refining. The base-metal matte was refined in Norway by Falconbridge, which recovered nickel and copper as well as some 10 tons of refined cobalt metal. Western Platinum launched a $33 million project to mine the UG2 reef, 100 to 350 meters below the Merensky Reef in the Rustenburg vicinity, and to recover some 50,000 troy ounces of platinum-group metals per year, as well as

byproduct chromite by flotation and a new, but orthodox, smelting technique.

The following table shows the percentage of the constituents in the precious metal fractions of South African and worldwide platinum deposits, adapted from D. L. Buchanan, "Platinum Group Metal Production from Bushveld Complex and Its Relationship to World Markets," University of Witwatersrand, Johannesburg, Republic of South Africa. Also shown are the average grades of the deposits as fractions of a troy ounce per ton and their resources in millions of troy ounces.

Country and deposit	Percentages of total platium-group metals						Ore grade	Reserves[1]
	Platinum	Palladium	Ruthenium	Rhodium	Iridium	Osmium	Troy ounce per ton	Million troy ounces
Republic of South Africa:								
Merensky Reef	61	26	8	3	1	1	0.252	547
UG2 chromite	43	35	12	8	2	--	.278	1,034
Platreef	43	48	4	3	1	1	.257	367
Canada: Sudbury	44	46	3.4	3.8	1.4	1.4	.025	8
U.S.S.R.: Norilsk	25	71	1	3	--	--	.122	200
Colombia: Placers	93	1	--	2	3	1	--	--
United States: Stillwater[2]	20.1	78.7	--	.7	.3	.2	.713	[3]225

[1]Calculated to 1,200 meters vertical depth.
[2]Percentages calculated from analysis reported in Preparation of Platinum-Palladium Flotation Concentrate from Stillwater Complex Ore, table 7, p. 12, by J. Bennetts, E. Morrice, and M. M. Wong. U.S. Department of the Interior, Bureau of Mines, Report of Investigations, 8500, 1981.
[3]Classed as a resource potential by National Materials Advisory Council.

Texasgulf financed smelting research in the United Kingdom and further developed its Expanded Precessive Plasma (EPP) technique to recover both platinum-group metal and chromium from the UG2 chromatite, but the method has not yet shown clear economic potential. South Africa's National Institute of Metallurgy (NIM) has done some research for Western Platinum showing that flotation recovered much of the chromite in marketable form from the UG2 layer ores and that subsequent hotter-than-normal smelting of platinum-group metal concentrate produced a slag containing more platinum and rhodium than those from normal smelting of Merensky reef concentrates. Although the nickel-copper sulfide concentrates still contained enough chromite that normal electric furnace smelting produced deposits on the furnace walls, the problem was overcome by blending chromite-bearing sulfide concentrate with normal platinum-group metal concentrates. These developing techniques could have far-reaching consequences for the platinum and chromium industries of South Africa and of the world.

Tin.—All three of the Nation's tin producers contributed to the slightly reduced output of tin during 1980 as continuing high prices provided the incentive for finding and treating lower grade ores. The Rooiberg Minerals Development Co. Ltd., managed by GFSA, continued its extensive prospecting program and finally discovered additional new ore sufficient to provide for 20 years' operations. The firm's new smelter supplied most of the country's demand for tin metal and the resulting doubling of the volume and the value of tin metal sold domestically caused a corresponding decrease in the volume and value of cassiterite (tin concentrate) available for export. ISCOR's Uis tin mine in neighboring Namibia was the source of cassiterite imported for smelting in ISCOR's Vanderbijlpark facility. GFSA's Union Tin Mines Ltd. found another 3 years' underground reserves late in 1980, while continuing its program of dump retreatment. The third producer, Zaaiplaats Tin Mining Co. Ltd., lost the toll smelting of Rooiberg's concentrates when the latter's smelter was completed. It was able to maintain smelter availability for the reduced amount of cassiterite recovered from its underground mine by the marginally profitable expedient of resmelting old slag.

Titanium Slag, Rutile, and Zircon.—From 1955 to 1963, moderately large-scale beach sand dredging operations used gravity, magnetic, and electrostatic separations to produce ilmenite, rutile, and zircon concentrates at Umgababa, 40 kilometers south of Durban on Natal Province's Indian Ocean coast. In July 1977, operations commenced at the $300 million Richards Bay minerals project, 160 kilometers north

of Durban, and in 1980, output reached near-capacity levels for both Tisand (Pty.) Ltd. and Richards Bay Iron and Titanium Ltd. (RBIT). Both operations were 40% owned by, and the second was managed by, Kennecott Copper Co.'s Quebec Iron and Titanium Inc. of Canada. Other shareholders included Gencor Ltd., 30%; IDC, 20%; and 10% was jointly owned by the South African Mutual Life Assurance Society and the Southern Association. The 1980 production of 85% titania slag by RBIT from Tisand's ilmenite concentrate was 360,000 tons, and 195,300 tons of low-manganese pig iron was its coproduct. Rutile concentrate output was 50,400 tons and 103,500 tons of zircon sand was also produced. The Richards Bay ancient dune sand deposit was parallel to and some 3 to 6 kilometers west of the present beach and has been explored over a width of 2,000 meters for a north-south distance of 17 kilometers. The deposit included some 700 million tons of sand with about 6% ilmenite, 0.3% rutile, 0.6% zircon, and small amounts of garnet and monazite.

Tisand operated two dredges in a self-made pond. Dune sand was pumped from the pond sides and bottom to a floating concentrator (wet mill) equipped with 54 Reichert cone stacks that made an 85% heavy mineral concentrate that was pumped to an onshore stockpile. The rough concentrate was trucked 8 kilometers to a permanent concentrator (dry mill) site at RBIT's main facility, where magnetite was removed by low-intensity drum magnets and stockpiled. High-intensity wet-magnetic separators then removed the ilmenite, and electrostatic separators made a rutile and a nonmagnetic heavy concentrate composed chiefly of zircon. High-tension roll separators and high-intensity dry magnets were used to purify the zircon concentrate. The ilmenite concentrate was smelted in RBIT's electric furnace where Natal anthracite reduced the iron to molten metal and left the titania in the slag. Most of the slag and other products were exported to consumers in the Northern Hemisphere. Prior to mining, timber was harvested from the land adjacent to the pond and half a meter of topsoil was removed to be replaced after the tailings had refilled a mined-out segment of the pit. Casuarina windbreaks were planted to control wind erosion on the reclaimed land, which was planted with grasses and used for grazing.

Uranium.—Production of uranium oxide (U_3O_8) in concentrate increased 29% to an alltime record of 7,295 tons in 1980, bringing the country's aggregate output to 110,497 tons since the first production by West Rand Consolidated Mine in September 1952. Table 6 shows the output of 10 major producing mines and 2 tailings treatment plants during the past 4 years. Most of the U_3O_8 production was derived from uraninite and other radioactive minerals associated with the gold-bearing conglomerates (reefs) of the Witwatersrand fossil placers. A minor amount was recovered as byproducts of copper and phosphate mining in the Palabora carbonatite deposit in northeastern Transvaal. The largest producers, AAC's Vaal Reefs, improved production by 38% over that of 1979 partly because operations commenced at their Afrikander Lease Area where uranium mineralization was more important than the gold. The JCI Randfontein operations increased output by 57% as the snags were gradually worked out of their Cooke Section and Millsite treatment plants. Sinking of a third shaft at Cooke Section was approved in March, and production was scheduled to be started in 1985 from high-grade uranium ore at the relatively shallow depth of 1,000 meters. The estimated cost, reported at $257 million, did not include a separate ventilation shaft to be sunk later if required.

In January 1980, the Nuclear Fuels Corp. (Nufcor), through which all South African uranium producers except Palabora market their product, announced its negotiation of a sales contract on behalf of JCI's Western Areas. Terms included an interest-free loan of $38.6 million with repayment to start with deliveries of concentrate in 1983. Initial production of uranium-rich ore was scheduled at 80,000 tons per month and was to supplant a similar tonnage of ore from the gold reefs.

AAC's Joint Metallurgical Scheme reported a 44% increase in uranium production in 1980 to maintain its position as the country's second largest U_3O_8 producer. However, its plant was treating current tailings (and some U_3O_8 concentrate) as well as a small amount of reclaimed old tailings from six of AAC's gold-mining subsidiaries in Orange Free State. AAC's East Rand Gold and Uranium Co. Ltd. (Ergo) increased uranium recovery by 24% at its tailings retreatment plant 35 kilometers southeast of Johannesburg. The Ergo plant continued to treat tailings from nearly 20 old slimes dams. The final product of the uranium

section was a precipitate of ammonium diuranate (yellow cake) in slurry form shipped in tank trucks to Nufcor.

NIM, one of the Republic's statutory research organizations, developed a new resin-in-pulp uranium recovery circuit, and during 1980, the first commercial-scale resin-in-pulp plant outside South Africa was ordered for installation in New Mexico. NIM's research installation at Randburg was reportedly one of the world's largest mineral-processing research complexes, with a staff of more than 700 employees, and an annual budget of $14 million. The capacity of UCOR's uranium enrichment plant was expanded to 50 tons per year of enriched uranium in mid-1980. It was claimed that this was sufficient to fuel the country's first nuclear power station at Koeberg in the Cape Province after it was commissioned in 1982.

Table 6.—Republic of South Africa: Production of U_3O_8, by producer

(Kilograms)

Company or mine	1977	1978	1979	1980
AAC Joint Metallurgical Scheme[1]	312,750	653,059	676,262	977,116
Blyvooruitzicht	199,949	292,212	285,710	324,482
Buffelsfontein	653,200	620,000	620,400	603,800
East Rand Gold and Uranium Ltd. (Ergo)	--	117,828	238,734	295,314
Free State Saaiplaas	45,545	--	--	--
Harmony	535,820	534,839	540,925	490,822
Hartebeestfontein	377,405	365,889	394,210	435,242
Palabora Copper	88,661	140,860	121,252	170,369
Randfontein	3,635	96,081	412,959	646,452
Vaal Reefs	1,016,955	1,059,851	1,273,415	1,758,386
West Driefontein	295,567	295,119	288,274	251,656
West Rand Consolidated	265,559	312,914	367,512	385,924
Western Deep Levels	167,410	183,365	199,002	212,562
Miscellaneous	--	--	218,345	743,250
Total	3,962,456	4,672,017	5,637,000	7,295,375

[1]Includes recovery of U_3O_8 from concentrates and tailings produced by the Free State Geduld, Free State Saaiplaas, President Brand, President Steyn, Welkom, and Western Holdings Mines, all subsidiaries of Anglo-American Corp. in the Orange Free State Province.

Vanadium.—The largest reserves of exploitable vanadium in the world were in the titaniferous magnetites of the Bushveld Igneous Complex in the Republic of South Africa. The country's and the world's leading vanadium producer continued to be AAC's Highveld Steel and Vanadium Corp. Ltd. Ore from the Steelport-Roossenekal area of Transvaal was treated in Highveld's Witbank plant, which had the capacity to produce 12,000 tons per year of vanadium pentoxide (V_2O_5). Ucar Minerals Corp. Ltd., a subsidiary of Union Carbide S.A. Ltd., operated plants at Brits and Bon Accord near Pretoria with a combined capacity of 2,000 tons of V_2O_5 per year. The Bon Accord plant was shut down in October 1980. Otavi Mining Co. Ltd. operated a 1,500-ton-per-year V_2O_5 plant near Wapadskloof in Transvaal. Both Samancor and RTZ were reported to control unexploited sources of vanadiferous magnetite ore. All statistics about the production and sales of vanadium ores or products were classified by the Government in 1980.

Zinc.—ISCOR's galvanizing plant at Vanderbijlpark has used zinc metal derived from concentrates imported from Namibia's Rosh Pinah Mine and milling operation for a number of years. In 1972, the Prieska Copper Mines commenced the production of sphalerite (zinc sulfide) concentrate from its four-product mine at Copperton, 65 kilometers southwest of Prieska. Production has continued at a rate of 100,000 to 150,000 tons of zinc concentrate per year. Part of the zinc concentrate was sold to GFSA's ZINCOR smelter-refinery at Springs in Transvaal, which also imported zinc concentrate from overseas. In 1980, BMD reportedly produced some 15,000 tons of zinc concentrate from its Broken Hill ore body in northwest Cape Province, and shipped it to the ZINCOR refinery. Future production was envisaged at the rate of 18,000 tons per year of contained zinc. ZINCOR installed new hot-acid leach equipment at its hydrometallurgical plant at Springs and reported a subsequent improvement in the recovery of zinc metal.

NONMETALS

Asbestos.—Both production and export sales of asbestos declined in 1980 for the third straight year. The Republic of South

Africa produced some chrysotile asbestos, but most of the output was of the crocidolite and amosite varieties for which the country remained the major world source. Cape Blue crocidolite was the most important variety economically and has usually accounted for more than one-half the total value of annual asbestos sales. Three major companies accounted for most of the Republic's asbestos production in 1980. Gencor Ltd. owned two asbestos-producing subsidiaries, Griqualand Exploration and Finance Co. Ltd. and Msauli Asbes Beperk. Griqualand's operations in the Kuruman district of Cape Province produced about 50,000 tons per year of Cape Blue crocidolite fiber. The country's largest producer of crysotile asbestos was the 85,000-ton-per-year Msauli property at Barberton in Transvaal.

Cape Blue Mines (Pty.) Ltd. and Egnep (Pty.) Ltd. were administered by Cape Asbestos South Africa (Pty.) Ltd. Cape Blue produced blue crocidolite from its Pomfret and other mines in northern Cape Province. Egnep's Penge Mine in Lydenberg district, Transvaal, continued to be the world's largest producer of amosite asbestos, with the capacity to produce 100,000 tons per year.

Cape Blue crocidolite fiber was also produced by Kuruman Cape Blue Asbestos (Pty.) Ltd. and Danielskuil Cape Blue Asbestos (Pty.) Ltd., subsidiaries of Asbestos Investment (Pty.) Ltd. and owned by the European Eternit Group. Kuruman's mines had a total capacity of 48,000 tons per year and Danielskuil's mine could produce 15,000 tons per year, all from Cape Province.

Cement.—Despite the loss of more than 50% of its export cement sales due to the overthrow of the Iranian Government and unrest in the Middle East, the Republic of South Africa had a record year for its cement industry because of the countrywide boom in the construction industry. A 21% increase over that of 1979 in volume of cement sales was reported for 1980 when total sales reached a new record of 7.4 million tons. Production facilities were reportedly more than 85% utilized, and transport facilities were claimed to be the bottleneck restricting higher sales. The chief construction projects included the new Sasol II and III oil-from-coal plants and ancillary buildings, the Drakensburg dam, water diversion system and irrigation scheme, and the Koeberg powerplant near Cape Town. There was a general expansion of the mining and other industries throughout the country, which included provision of housing and facilities for employees.

Blue Circle Ltd. was adding a 1,430-ton-per-day kiln plant, 207 feet in length, to its Lichtenburg operation and reported plans to double its output at a later date. Cape Portland Cement Co. Ltd. put a 1,600-ton-per-day preheater kiln onstream at its De Hoek plant in 1980. A 45,000-ton-per-year plant was to be built at Port Shepstone on the Natal south coast. The plant was scheduled to supply the Durban vicinity and reduce the transport of clinker from western Transvaal.

Diamond.—There was an increase of nearly 2% in the overall production of diamond (gem and industrial) in the Republic of South Africa during 1980 and a 3.3% increase in the number of carats sold. The total sales value of the marketed diamonds increased marginally but did not reflect a reduction of world market prices, but rather a diminution in the average size or quality of the diamonds marketed. The output of low unit value mine diamonds increased by 10%, while production of the more highly valued alluvial diamonds decreased by 17% in 1980.

The marketed output of diamonds in carats and the average prices in U.S. dollars per carat realized for diamonds from various sources in the Republic of South Africa are shown in table 7.

The world's largest diamond-producing company continued to be De Beers Consolidated Mines Ltd. with headquarters at Kimberley in northeastern Cape Province. De Beers' largest producer since 1979 was the Finsch open pit in a kimberlite pipe 150 kilometers northwest of Kimberley in Cape Province. Underground extraction of ore started from an inclined ramp on February 18, 1980. Total ore production during 1980 was 3,864,900 tons and came mostly from the 160- to 220-meter benches of the open pit, while overburden extraction continued from the 112- to 136-meter levels. The ore grade averaged 75.21 carats per 100 tons yielding 2,906,961 carats, a 12% increase over the 1979 production.

Of the four kimberlite mines within 6 kilometers southeast of the town of Kimberley in Cape Province, the Wesselton underground mine had the largest output with 329,861 carats produced from 1,397,100 tons of ore at a grade of 23.61 carats per 100 tons. The Bultfontein pipe, also mined underground, produced 681,400 tons of ore with 38.83 carats per 100 tons, or 264,611 carats of diamond from the 580- and 700-meter levels. Drainage tunnels excavated south-

west of the pipe yielded substantial quantities of water. The return airway to the joint ventilation shaft and fan chamber was completed during the year. The 1,157,200 tons of ore recovered from Bultfontein floors dumps yielded 319,313 carats at a grade of 27.59 carats per 100 tons. Sampling of other dumps in the area continued, and the hydraulic excavator was converted from diesel to electric power during the year.

At the nearby Dutoitspan underground mine, 603,800 tons of ore from the 760-meter level block cave area yielded 123,264 carats of diamond at a grade of 20.41 carats per 100 tons. The system of water tunnels around the pipe was nearly completed and was draining substantial quantities of water from the surrounding strata. Production from the De Beers underground kimberlite mine yielded 135,993 carats from 665,800 tons of ore from the 620- and 745-meter levels at a grade of 20.43 carats per 100 tons. At the Kamfersdam kimberlite some 5 kilometers to the north, an access ramp was advanced 689 meters to within 206 meters of the pipe. Completion of the ramp and sampling of the 225-meter level of the pipe were scheduled for 1981.

At the Koffiefontein kimberlite mine in Orange Free State Province, nearly 80 kilometers southeast of Kimberley, some 3,645,700 tons of ore was treated and the grade improved from 11.24 to 11.84 carats per 100 tons, resulting in a 5% increase to 431,480 carats of diamond recovered in 1980. Development of the 522-meter level haulages, main tip, crusher, and conveyor installations were completed by yearend. Open pit mining was scheduled to end and underground mining was to start by March 1981.

The Premier kimberlite mine in Transvaal Province, about 10 kilometers northeast of Pretoria, was for many years the Nation's largest producing diamond mine and was still first in ore production in 1980 when 7,597,700 tons of ore was treated to recover 2,039,186 carats of diamond at a rate of 26.84 carats per 100 tons. Of this, the underground mine produced 5,239,400 tons of ore with a grade of 29.36 carats per 100 tons for 1,538,193 carats of diamond, while dump retreatment involved 2,358,300 tons of ore with 21.24 carats per 100 tons for 500,993 carats of diamond. Development below the gabbro still was generally behind schedule because of poor ground conditions that required the installation of additional support in the crusher area. A new heavy media plant for treating fine ore was commissioned at yearend and was expected to recover more small diamonds than had been possible with the jig plant.

Virtually all of South Africa's alluvial diamonds were recovered by the various units of De Beers' Namaqualand Div. along the western coast of Cape Province. De Beers' alluvial output totaled 1,434,262 carats while production from the State Alluvial Diggings at Alexander Bay was 139,114 carats, and a smaller company operating offshore produced nearly 50,000 carats. De Beers' largest alluvial operation was the Koingnass Complex where 22.4 million tons of overburden was excavated and 1,842,100 tons of ore (diamondiferous gravel) was treated, including 341,500 tons mined at Mitchells Bay, 26 kilometers to the south. Washed gravels were transported to the Koingnass diamond recovery plant, where they were treated, along with the recovery from 1.5 million tons of Koingnass gravel. The overall yield of 635,321 carats indicated an average grade of 34.49 carats per 100 tons. At Dreyers Pan, mining was halted in midyear after 755,300 tons of gravel yielded 87,425 carats of diamond at a grade of 11.58 carats per 100 tons. In the latter part of 1980, the bulk sampling plant resumed operations near Dreyers Pan and treated 470,600 tons of gravel to recover 61,951 carats of diamond at a grade of 13.16 carats per 100 tons.

In May 1980, a new recovery plant was commissioned at Tweepad and was staffed with personnel from Dreyers Pan. During the latter half of the year, 1,309,000 tons of gravel yielded 144,348 carats at an average grade of 11.03 carats per ton. At Annex Kleinzee, 3,068,200 tons of gravel was treated at an average grade of 14.98 carats per 100 tons and yielded 459,573 carats of diamond. Some of the Annex Kleinzee gravels came from adjacent farms including the southern part of the Dreyers Pan lease. Overburden stripping in these areas totaled 33,715,600 tons and was expected to increase in 1981 when delivery of a new 46-cubic-meter-capacity dragline was expected. At the Langhoogte Mine, 35 kilometers to the east, gravel production was 339,800 tons at 13.43 carats per 100 tons for a yield of 45,644 carats. An 86-kilometer pipeline was completed during 1980 to bring potable water fron Nababeep to Kleinzee. Pressure testing and commissioning were in progress at yearend.

Table 7.—Republic of South Africa: Marketed diamond output, by province

Province	1978		1979		1980	
	Output (carats)	Price per carat	Output (carats)	Price per carat	Output (carats)	Price per carat
Mine diamond:						
Transvaal	1,940,755	$31.95	2,033,993	$39.60	2,342,714	$39.92
Cape Province	3,593,972	44.38	3,680,787	45.58	3,902,256	52.04
Orange Free State	408,802	113.97	441,050	117.34	531,708	167.92
Total	5,943,529	45.10	6,155,830	48.75	6,776,678	56.94
Alluvial diamond:						
Transvaal	16,274	294.18	22,268	325.21	26,882	506.93
Cape Province	1,430,273	168.17	1,995,046	172.45	1,645,920	189.12
Orange Free State	23	26.00	7	261.80	764	115.13
Total	1,446,570	169.07	2,017,321	174.13	1,673,566	194.19
Grand total	7,390,099	69.37	8,173,151	79.70	8,450,245	84.13

Source: Republic of South Africa Department of Mineral and Energy Affairs, Quarterly Information Circular, Minerals, October-December 1980, p. 2. 1 Rand = US$1.2854 for 1980.

Fluorspar.—Production of fluorspar increased nearly 15% to a new record of 523,000 tons maintaining the country as the second largest producer in the world after Mexico. Export sales also increased more than 20% to 443,000 tons with a sales value of $43.8 million. Most of the production consisted of acid-grade fluorspar, with 97% or more CaF_2. Early in 1980, Derby Metals and Minerals S.A. Ltd. announced that it had acquired Marico Fluorspar (Pty.) Ltd., formerly a subsidiary of United States Steel Corp. and the country's largest producer. Derby's affiliate, Rand Mines Ltd., was to become technical manager of the operation. Marico's annual capacity was 120,000 tons per year of acid-grade fluorspar and 40,000 tons per year of metallurgical-grade fluorspar from their mine near Zeerust, in northwestern Transvaal. Gencor's Buffalo Fluorspar (Pty.) Ltd. was reported as operating the world's largest acid-grade fluorspar mine with a capacity of 150,000 tons per year at its mine near Naboomspruit in Transvaal. Buffalo's better ore contained abnormal amounts (0.25%) of P_2O_5 and its mining was discontinued in favor of lower grade (12% to 15% CaF_2) ores with 0.03% P_2O_5. Chemspar Ltd., a subsidiary of Phelps-Dodge and Vergenoeg Mining Co. Pty. Ltd., owned by Bayer A.G., each had a 90,000-ton-per-year capacity, and Ruigtepoort Fluorspar Mines (Pty.) Ltd. had a reported annual output of 25,000 tons.

Phosphate.—The Government-controlled Foskor continued to produce most of the Republic's phosphate from the Palabora carbonatite complex in northeastern Transvaal Province. Like the neighboring PMC copper mine, Foskor installed mobile crushing units feeding shiftable conveyor bridges and belts in order to reduce truck haulage of its foskorite ore and PMC's phosphate-rich waste rock and thus to conserve diesel fuel. After diamond drilling had outlined larger and deeper extensions to the phosphate enriched carbonatite, Foskor was assessing a possible plant expansion that could double the production of phosphate concentrate. In 1980, nearly 20 million tons of ore was treated to produce nearly 3.5 million tons of concentrate. Triomf Fertilizers (Pty.) Ltd. at Richards Bay, and the smaller Federale Kunsmis Ltd. (Fedmis), near the PMC plant, purchased most of Foskor's concentrate, and their combined output was more than 500,000 tons of phosphoric acid in 1980, mostly for export. Fedmis operated its own phosphoric acid plant, which consisted of a 72,000-ton-per-year No. 1 unit, plus No. 2 and No. 3 units with a combined capacity of 221,000 tons per year of phosphoric acid. Simon Carves Pty. Ltd. (Africa) had contracted to enlarge the No. 2 and No. 3 units by 30%. The No. 3 sulfuric acid plant was also enlarged, and a new 200,000-ton-per-year sulfur-burning plant was completed by yearend.

MINERAL FUELS

Coal.—For the third straight year, the value of the country's coal production has exceeded $1 billion, and the value of coal exports reached the equivalent of $884 million in foreign exchange, an increase of 35% over that of 1979 in terms of domestic currency. An increasing amount of coal was

used to generate electrical energy as both coal and ore transport vehicles were converted from diesel consumption to part electric drive. The country's 78 producing collieries supplied 72% of the country's energy requirements. The coal consumption at the Sasol II oil-from-coal plant also increased as additional units commenced functioning.

ISCOR commissioned its $300 million Grootegeluk opencast coal mine near Ellisras in northwestern Transvaal for opening on April 15, 1980, as its major source of 1.8 million tons per year of mixed coking coal for its metallurgical requirements. Grootegeluk's middlings were scheduled to supply a planned Electricity Supply Commission (ESCOM) power station. In order to reduce diesel-powered truck haulage, ISCOR was installing 22-cubic-meter Parkinson and Howard electric shovels that loaded overburden through 3,000-ton-per-hour mobile gyratory crushers and fed shiftable 110-meter-long bridge conveyors linked to crawler-mounted spreaders at the dumps.

On January 25, 1980, Rand Mines opened its new opencast Duvha coal mine designed to supply ESCOM's Duvha power station under construction nearby. The power station had a capacity of six 600-megawatt units and the Duvha Colliery was to provide its fuel for 35 years. Mining was to utilize three 53-cubic-meter draglines and two smaller draglines when full production was achieved in 1986.

GFSA installed a $1.5 million beneficiation unit for fine coal at its Greensides Colliery near Witbank to produce 4,000 tons per month of low-ash fine coal for export to European power stations. The new plant was integrated with GFSA's No. 2 seam plant, which treated 160,000 tons per month of raw coal.

The facilities of the Richards Bay Coal Terminal Co. (RBCT) were established in 1970 to supply Japanese steelmakers with 27 million tons of coal from the Transvaal Coal Owners Association and to relieve the port of Durban. The port capacity was 12 million tons per year in 1976 and had expanded to 20 million tons per year by April 1979. In 1978, the Government authorized further expansion to 44 million tons per year at a cost to RBCT of $296 million. Upgrading of the railroad was handled by SARAH, which also was planning construction of additional harbor facilities including two new quays. The two original quays were 360 meters in length and could load 150,000-deadweight-ton bulk carriers at the rate of 6,500 tons per hour. Some $60 million was to be spent for dredging the harbor to handle 250,000-ton bulk carriers during the next 2 years. Bituminous coal from Transvaal was brought to the port in trains of 84 trucks with a total capacity of 4,900 tons, while Natal anthracite was carried in smaller block trains of 2,500-ton capacity.

Petroleum.—The Republic of South Africa continued to import crude oil, but an increasing amount of its refineries' requirements were met by the combined output of synthetic crude (syncrude) from its Sasol I and II plants. The full-scale Sasol II plant at Secunda was reportedly producing at 40% of its total capacity and was consuming about 135,000 tons per week of coal from the nearby Bosjesspruit Colliery. At the adjacent Sasol III plant, construction was about 35% complete and commissioning for full production was scheduled for 1984. Security around the construction site was intensified following explosions that destroyed liquid fuels worth approximately $5.5 million at Sasolburg and Secunda early in 1980.

The Government-owned Southern Oil Exploration Corp. (Pty.) Ltd. (Soekor) continued offshore exploration throughout 1980. In December, its FA2 well, 90 kilometers south of Mossel Bay, intersected a 70-meter section of rock including three layers of hydrocarbon-bearing sandstone at depths slightly in excess of 2,700 meters. Initial testing of the upper layer indicated a flow of 11 million cubic feet of gas per day accompanied by some 200 barrels of gas condensate or very light oil. The second layer produced a test of 8 million cubic feet of gas and 100 barrels of condensate per day. Soekor was planning additional seismic surveys to determine the extent of the field and additional drilling to explore the extent and uniformity of the reservoir.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from South African rand (R) to U.S. dollars at the rate of R1=US$1.19 for 1979, and at R1=US$1.2854 for 1980, as shown in International Financial Statistics, v. 34, No. 7, pp. 348-350.

The Mineral Industry of Spain

By Roman V. Sondermayer[1]

Spain continued to make efforts to increase domestic production of minerals, with an aim to lower imports of raw materials for its fast growing industry and to cut the trade deficit, which was largely caused by imported liquid fuels.

During 1980, Spain remained an important producer and processor of minerals in Europe, with output of several minerals that were significant to the world economy. Spain's approximate share of world output of these minerals was mercury (17%), pyrite (11%), fluorspar (7.3%), and potash (2.8%).

The Spanish mineral industry contributed about 11% of the gross national product. The share of petroleum refining was 10%, and the extractive segment was only about 1%. Total employment in the mineral sector was close to 600,000 persons, of which mining employed about one-third.

The overall economic situation in the country was similar to that in other European countries. Unemployment was near 12%, and inflation was just over 15%. Except for the mineral industry, all activities were depressed, including the energy sector.

In 1980, major events of the mineral industry included completion of an alumina plant at San Ciprian in northern Spain; Rio Tinto Zinc of the United Kingdom (RTZ) increased its holding in Rio Tinto Minera (RTM), the largest producer of copper in Spain, from 25% to 49%; exploration for iron ore in southern Spain; the startup of a new opencast mercury mine near Almaden; and the construction of a strontium compound plant and modernization of a strontium mine near Granada.

PRODUCTION

The mineral industry of Spain is owned by the Government and by private capital. Government manages most of its companies through Instituto Nacional de Industria (INI). A following tabulation shows the structure of the industry.

Table 1.—Spain: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Bauxite	13,500	[r]9,614	9,274	16,845	20,000
Metal:					
Primary	210,516	211,167	212,100	259,511	[2]386,492
Secondary	40,000	40,000	39,100	42,000	43,000
Antimony, mine output, metal content	260	[r]331	442	501	[2]625
Arsenic, white[e]	10	10	10	--	--
Cadmium metal	246	303	253	222	[2]309
Copper:					
Mine output, metal content	35,555	[r]43,021	39,259	43,708	[2]35,916
Metal:					
Blister:					
Primary	[r]92,500	[r]99,500	95,500	90,300	95,000

See footnotes at end of table.

Table 1.—Spain: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Copper —Continued					
Metal —Continued					
Blister —Continued					
Secondary	[r]20,000	[r]18,000	17,000	18,000	20,000
Total	[r]112,500	[r]117,500	112,500	108,300	115,000
Refined:					
Primary	110,000	130,000	117,000	119,400	127,700
Secondary	[r]31,000	29,000	30,000	25,000	30,000
Total	[r]141,000	159,000	147,000	144,400	157,700
Gold, mine output, metal content—troy ounces	148,601	[r]117,800	102,882	91,404	90,000
Iron and steel:					
Iron ore and concentrate:					
Gross weight—thousand tons	8,227	8,327	8,580	8,827	[2]8,865
Iron content—do	4,073	4,122	3,906	3,994	[2]3,983
Metal:					
Pig iron—do	6,624	6,605	6,253	6,508	6,500
Electric furnace ferroalloys—do	299	301	365	395	400
Steel:					
Crude—do	10,910	10,921	11,345	12,200	[2]12,671
Castings and forgings—do	92	181	300	48	50
Total—do	11,002	11,102	11,645	12,248	12,721
Semimanufactures—do	12,017	12,164	10,801	9,202	[2]9,472
Lead:					
Mine output, metal content	62,196	[r]65,540	71,341	72,262	[2]72,549
Metal:					
Primary	[r]73,241	89,177	83,400	87,200	[2]84,300
Secondary	[r]28,500	[r]29,400	38,800	39,800	[2]39,700
Mercury:					
Mine output, metal content					
76-pound flasks	42,729	[r]26,850	29,588	33,275	33,000
Metal—do	40,147	[r]27,031	31,037	32,375	34,000
Silver:					
Mine output, metal content					
thousand troy ounces	3,222	[r]2,966	2,924	3,168	3,000
Metal, primary—do	3,107	NA	NA	NA	NA
Tin:					
Mine output, metal content	390	[r]641	711	496	[2]427
Metal, primary	5,369	5,343	4,575	4,412	4,500
Titanium dioxide	21,110	39,478	39,336	[e]40,000	40,000
Tungsten, mine output, metal content	329	[r]307	358	394	[2]377
Uranium, mine output, U_3O_8 content	228	[r]254	284	349	[2]408
Zinc:					
Mine output, metal content	83,370	[r]98,316	146,844	142,745	[2]169,570
Metal primary and secondary	[r]161,136	[r]156,600	177,000	182,700	[2]151,800
NONMETALS					
Barite	[e]92,695	[r]84,280	71,457	74,700	73,000
Bromine[e]	408	408	408	408	400
Cement, hydraulic, other than natural					
thousand tons	25,202	27,995	30,233	27,912	[2]28,460
Chalk—cubic meters	115,808	179,936	159,759	163,174	165,000
Clays:					
Attapulgite	[3]23,046	[3]35,812	39,230	62,423	NA
Bentonite	108,148	[r]114,600	108,318	120,678	120,000
Kaolin, marketable:					
Crude	[e]140,000	[r]66,490	57,961	72,425	71,000
Washed	207,180	232,145	193,136	204,106	205,000
Refractory, not further described	NA	352,519	294,799	427,817	NA
Other—thousand cubic meters	8,517	9,165	8,984	8,590	8,500
Diatomite and tripoli	[e]17,150	28,281	21,370	27,196	27,000
Feldspar and pegmatite	90,964	93,222	116,283	115,685	116,000
Fluorspar:					
Gross weight:					
Acid-grade	221,977	211,825	201,505	155,278	[2]199,254
Metallurgical-grade	64,676	98,636	99,790	37,620	97,000
Total	286,653	310,461	301,295	192,898	296,254
CaF_2 content:					
Acid-grade	215,766	[r]205,905	195,994	150,327	[2]193,126
Metallurgical-grade	[r]49,807	[r]75,960	76,893	28,600	75,000
Total	[r]265,573	[r]281,865	272,887	178,927	268,126

See footnotes at end of table.

Table 1.—Spain: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Gypsum and anhydrite, crude thousand tons	[e]4,200	5,482	5,369	5,275	5,500
Kyanite and related materials: Andalusite	5,743	[r]2,981	5,087	5,355	5,100
Lime, hydrated and quicklime[e] thousand tons	400	400	350	400	450
Magnesite:					
Calcined	NA	161,869	128,627	147,761	NA
Crude	[e]348,082	421,241	306,548	381,867	380,000
Meerschaum (sepiolite)	[e]66,498	97,630	131,817	202,810	NA
Mica	[e]500	[r]2,934	3,345	5,169	5,000
Nitrogen: N content of ammonia thousand tons	1,051	965	880	820	800
Pigments, mineral:					
Ocher	8,983	12,365	12,227	15,078	15,000
Red iron oxide	27,151	36,261	[e]24,000	[e]25,000	25,000
Potash salts, K_2O equivalent	630,252	561,630	612,581	667,560	[2]660,439
Pumice	120,839	[r]931,793	902,402	779,118	770,000
Pyrite including cuprous, gross weight thousand tons	2,349	[r]2,423	2,292	2,366	[2]2,439
Salt:					
Rock do.	1,200	[r]1,901	2,092	2,187	2,200
Marine and other do.	1,159	[r]1,200	1,277	1,260	1,300
Sand and gravel: Silica sand do.	1,622	[r 4]2,844	[4]2,438	[4]2,178	NA
Sodium compounds:					
Sodium carbonate, manufactured do.	524	[r e]320	499	500	505
Sodium sulfate:					
Natural:					
Glauberite, Na_2SO_4 content	55,390	73,705	104,492	101,780	102,000
Thenardite, Na_2SO_4 content	108,938	107,411	102,975	106,022	106,000
Manufactured	166,380	174,307	121,704	[e]175,000	175,000
Stone:					
Calcareous:					
Dolomite thousand cubic meters	1,120	[r]1,077	1,168	1,145	NA
Limestone do.	41,219	44,732	42,166	40,019	NA
Marble do.	289	311	292	333	NA
Marl do.	30,062	2,863	2,896	3,404	NA
Basalt do.	2,763	[r]783	617	636	NA
Granite do.	2,717	2,683	3,144	3,191	NA
Ofite do.	426	631	557	610	NA
Phonolite do.	148	169	171	242	NA
Porphyry do.	126	105	179	169	NA
Quartz thousand tons	[e]598	650	717	790	NA
Quartzite thousand cubic meters	249	205	219	230	NA
Sandstone do.	634	1,008	858	620	NA
Serpentine thousand tons	NA	263	306	409	NA
Slate thousand cubic meters	599	619	583	656	NA
Trass and tufa do.	241	NA	NA	NA	NA
Other do.	16,481	[r]17,265	17,232	17,554	NA
Strontium minerals:					
Gross weight	[e]7,500	[r]11,000	14,000	18,000	18,200
Sr_2O_4 content	[e]6,600	[r]9,680	12,320	16,560	16,000
Sulfur:					
S content of pyrite	1,052	[r]1,099	1,046	1,091	[2]1,125
Byproduct:					
Of metallurgy	123	129	117	120	125
Of petroleum	4	5	10	10	12
Of coal (lignite) gasification	1	2	3	3	3
Talc and steatite	47,617	60,070	61,892	71,047	70,000
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	[e]12,065	14,556	13,100	8,710	NA
Carbon black	50,336	52,745	[e]53,000	53,000	54,000
Coal:					
Anthracite thousand tons	3,548	[r]3,761	3,831	3,796	[2]4,026
Bituminous do.	6,969	[r]8,115	7,668	8,049	[2]8,708
Lignite do.	4,150	[r]5,813	8,272	10,696	[2]15,918
Total do.	14,667	[r]17,689	19,771	22,541	[2]28,652
Coke, metallurgical do.	4,356	4,276	3,886	3,897	4,000
Fuel briquets:					
Briquets do.	10	7	7	6	NA
Ovoids do.	84	69	43	40	40
Gas, natural, marketed million cubic feet	41	[r]152	531	363	300
Peat	30,552	41,721	31,519	46,379	46,000
Petroleum:					
Crude thousand 42-gallon barrels	11,552	[r]7,203	7,134	8,383	[2]11,732

See footnotes at end of table.

Table 1.—Spain: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products:					
Gasoline, motor thousand 42-gallon barrels	44,288	44,750	46,719	46,844	[2]45,452
Jet fuel do	17,489	16,282	19,055	17,928	[2]17,091
Kerosine do	1,284	2,264	893	473	[2]1,061
Distillate fuel oil do	77,221	96,434	78,136	83,272	[2]80,219
Residual fuel oil do	163,758	137,246	138,875	139,663	[2]151,365
Lubricants including grease do	1,677	1,791	1,706	1,657	[2]2,386
Other do	48,388	39,170	44,289	[e]44,000	[2]47,346
Refinery fuel and losses do	22,032	16,896	20,848	[e]21,000	21,700
Total do	376,137	354,833	350,521	354,837	366,620

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Sept. 1, 1981.
[2]Reported figure.
[3]In previous editions, reported as "Earths, industrial, n.e.s."
[4]Includes sand obtained as a byproduct of feldspar and kaolin production.

Commodity	Major companies	Location of principal facilities
Alumina	Alumina de Espana S.A	Plant of San Ciprian.
Aluminum	do	Do.
Do	Endasa S.A	Plant at Aviles and Valladolid.
Do	Aluminio de Galicia S.A	Plant at La Coruna and Sabinanigo.
Bituminous coal	Hunosa S.A	Mines in Asturia.
Cement	Cía. General de Asfaltos y Portland S.A	7 plants.
Copper ore	Rio Tinto Minero S.A	Mines at Rio Tinto.
Copper, refined	do	Refinery at Huelva.
Ferroalloys	Soc. Espanola de Carburos Metalicos S.A	Plant at Berga.
	Hidro Nitro Espanolas S.A	Plant at Monzon.
	Ferroaleaciones Espanolas S.A	Plant at Medina del Campo.
Iron ore	Cía. Andalusa de Minas S.A	Mine at Marquesado.
Lead ores	Sociedad Minera y Metallurgica de Penarroya de Espana.	Mines at Mantas des Los Azules, Union.
Lead smelter	do	Smelter at Santa Lucia.
Mercury	Cousejo de Administration de Minas de Almaden.	Mines and smelter at Almaden.
Petroleum, refined	Empresa Nacional del Petroleo S.A	Refineries at Valle de Escombreras and Puertolano.
Do	Cía. Esp. de Petroleos S.A	Refineries at St. Cruz de Tenerife, Algeciras.
Potash	Potasas de Navarra S.A	Mine near Pamplona.
Do	Minas de Potasas se Suria S.A	Mine near Suria.
Do	Union Explosivos Rio Tinto S.A	Mines at Balsarney-Sallent and Cardon.
Pyrite	Tharsis Sulfur and Copper Co. Ltd	Mines at Tharsis and La Zarza.
Steel	Empresa Nacional Siderurgica S.A	Work at Aviles, Felguera, Gijon-Moreda, Gijon-Verina.
Do	Altos Hornos de Vizcaya S.A	Work at Baracaldo-Sestao.
Zinc ore	Real Cía. Asturiana de Minas S.A	Mines at Reocin and Rubialres.
Zinc, smelter	do	Electrolytic zinc plant at San Juna de Neuva.

TRADE

During the last several years, Spanish imports of minerals heavily taxed the country's balance of payments; during 1980, this situation remained. Tables 2 and 3 show details of foreign trade of Spain in minerals as reported in Foreign Trade Statistics published by the Spanish Government.

Table 2.—Spain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	19	1,106	--	All to Portugal.
Oxides and hydroxides	47	69	--	Portugal 43; United Kingdom 11.
Metal including alloys:				
Scrap	219	684	15	Italy 589; Pakistan 40; West Germany 20.
Unwrought	5,838	42,870	499	Japan 24,777; Portugal 4,185; Netherlands 3,499.
Semimanufactures	10,790	21,755	3,627	France 7,442; Portugal 2,207; Finland 770.
Antimony metal including alloys, all forms	r464	593	18	Netherlands 294; France 127; Japan 69.
Bismuth metal including alloys, all forms	2	4	--	Mainly to Netherlands.
Cadmium metal including alloys, all forms	143	194	88	Belgium-Luxembourg 47; Netherlands 32.
Chromium:				
Chromite	14	4,099	--	Mainly to East Germany.
Oxide and hydroxide	20	72	--	United Kingdom 40; Colombia 18.
Copper:				
Ore and concentrate	36	98	--	All to West Germany.
Matte	689	325	--	Do.
Sulfate	736	297	279	Morocco 15.
Metal including alloys:				
Scrap	705	704	--	West Germany 405; Japan 101; United Kingdom 73.
Unwrought	52,375	35,856	(1)	Belgium-Luxembourg 12,799; France 6,258; West Germany 5,774.
Semimanufactures	17,629	20,065	1,071	Italy 4,457; Morocco 3,124; Portugal 2,008.
Gold:				
Waste and sweepings value	--	$20,318	--	All to West Germany.
Metal including alloys, unwrought and partly wrought -- thousand troy ounces	482	194	--	Switzerland 96; United Kingdom 64.
Iron and steel:				
Ore and concentrate except roasted pyrite thousand tons	r2,025	1,995	--	West Germany 641; Netherlands 576; Romania 391.
Roasted pyrite do	r320	330	--	West Germany 307; France 13.
Metal:				
Scrap	727	172	--	West Germany 75; Belgium-Luxembourg 60; Netherlands 22.
Sponge iron, powder, shot	11,737	13,397	1	Italy 5,263; West Germany 1,995; France 1,874.
Ferroalloys:				
Ferromanganese	47,242	53,481	9,401	Romania 14,795; West Germany 11,194; China, mainland 5,000.
Other	74,403	120,350	3,835	West Germany 43,745; United Kingdom 13,189; Japan 12,924.
Steel, primary forms	r264,605	248,421	1,790	Venezuela 57,995; Turkey 36,305; Syria 20,063.
Semimanufactures:				
Bars, rods, angles, shapes, sections thousand tons	2,391	2,742	156	U.S.S.R. 307; Saudi Arabia 281; West Germany 244.
Universals, plates, sheets	r933,077	802,304	156,088	West Germany 97,351; Greece 74,387; U.S.S.R. 58,786.
Hoop and strip	17,772	27,172	--	West Germany 11,134; France 4,722; Belgium-Luxembourg 2,599.
Rails and accessories	546	11,502	--	Mainly to Saudi Arabia.
Wire	43,228	39,114	850	China, mainland 12,724; Algeria 9,331; Portugal 4,010.
Tubes, pipes, fittings	406,927	364,364	40,275	West Germany 57,450; France 41,406; China, mainland 40,022.
Castings and forgings, rough	22,407	28,143	3,786	France 7,042; Canada 2,521; West Germany 2,358.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	59	34	--	All to France.
Oxides	101	20	--	Mainly to Portugal.
Metal including alloys:				
Scrap	22	--		
Unwrought	r10,548	19,644	1,000	U.S.S.R. 8,800; Belgium-Luxembourg 6,622; Italy 1,500.
Semimanufactures	227	1,293	73	France 727; Taiwan 182; Portugal 158.
Manganese:				
Ore and concentrate	133	138	--	All to Portugal.
Oxides	2,869	3,000	--	France 1,934; Italy 580; West Germany 253.
Mercury 76-pound flasks	42,932	37,798	12,183	Romania 7,484; East Germany 3,481; United Kingdom 2,872.
Molybdenum metal including alloys, all forms	57	724	--	Mainly to Netherlands.
Nickel metal including alloys:				
Scrap	359	302	--	West Germany 141; France 138.
Unwrought	18	193	7	Netherlands 105; West Germany 38; Portugal 15.
Semimanufactures	129	601	(1)	West Germany 507; Libya 58.
Platinum-group metals including alloys, unwrought and partly wrought troy ounces	578,713	47,615	--	Japan 32,151; Switzerland 5,016; France 4,855.
Selenium, elemental	10	1	--	Mainly to Netherlands.
Silver:				
Waste and sweepings[2] value	$76,694	$839,741	$396,862	Sweden $380,671; Finland $41,876.
Metals including alloys, unwrought and partly wrought thousand troy ounces	1,673	3,344	--	France 912; United Kingdom 579; West Germany 514.
Tin metal including alloys:				
Scrap	37	94	--	United Kingdom 66; West Germany 20.
Unwrought	331	567	--	Belgium-Luxembourg 180; Netherlands 155; United Kingdom 111.
Semimanufactures	91	58	--	Netherlands 40; Algeria 15.
Titanium oxides	12,476	12,894	1,581	France 3,890; West Germany 2,213; Bulgaria 1,100.
Tungsten:				
Ore and concentrate	387	615	--	West Germany 331; Netherlands 119; United Kingdom 104.
Metal including alloys, all forms	23	31	(1)	West Germany 26.
Zinc:				
Ore and concentrate	7,515	13,891	--	France 6,280; Algeria 3,850; Italy 2,050.
Oxides	869	659	--	Denmark 408; Belgium-Luxembourg 138; Italy 48.
Metal including alloys:				
Blue powder	602	954	39	France 723; West Germany 135; Portugal 55.
Unwrought and semimanufactures	81,923	84,106	62,178	West Germany 6,401; United Kingdom 6,297; Portugal 3,220.
Other:				
Ores and concentrates	62	141	1	Portugal 49; Netherlands 42; United Kingdom 25.
Ash and residue containing nonferrous metals	33,531	38,402	--	Sweden 13,285; East Germany 12,528; West Germany 7,036.
Oxides, hydroxides, peroxides of metals	r16,355	11,864	--	Kuwait 8,313; Algeria 2,669.
Metals including alloys:				
Alkali, alkaline-earth, and rare-earth metals	1	57	--	France 30; Ghana 16.
Pyrophoric alloys	60	18	--	Mainly to Portugal.
Base metals including alloys, all forms	r78	260	117	Netherlands 74; United Kingdom 28; Austria 23.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	2,547	2,039	--	West Germany 960; Sweden 400; Philippines 272.
Artificial corundum	2,104	2,780	114	Italy 1,305; West Germany 666; Portugal 243.
Dust and powder of precious and semi-precious stones, value, thousands	$28	$114	$66	Switzerland $22; Venezuela $7; Mexico $5.
Grinding and polishing wheels and stones	2,468	2,616	250	West Germany 894; Cuba 195; France 186.
Asbestos	33	41	--	Portugal 30; France 5; Mexico 4.
Barite and witherite	90,794	74,678	1,578	West Germany 31,939; Algeria 17,740; Republic of South Africa 10,948.
Boron materials:				
Crude natural borates	401	367	--	Mainly to Portugal.
Oxides and acid	2,986	781	632	Canada 126; Portugal 15.
Cement, thousand tons	9,830	9,592	453	Saudi Arabia 2,928; Nigeria 1,046; Venezuela 974.
Chalk	18,753	23,877	1	Algeria 6,836; Portugal 4,606; Libya 4,400.
Clays and clay products (including all refractory brick):				
Crude:				
Bentonite	37,881	39,876	--	Portugal 16,602; United Arab Emirates 8,500; Egypt 3,000.
Kaolin (china clay)	59,802	71,794	--	Poland 15,939; West Germany 15,303; Algeria 11,049.
Other	24,623	42,612	1,034	Portugal 6,707; United Arab Emirates 6,500; United Kingdom 4,759.
Products:				
Refractory (including nonclay brick)	r28,187	23,411	--	Egypt 6,769; Cuba 3,050; France 2,673.
Nonrefractory	308,085	335,265	18,711	France 86,374; Andorra 26,966; Saudi Arabia 25,026.
Cryolite and chiolite, kilograms	(1)	16	16	
Diamond:				
Gem, not set or strung, value, thousands	--	$139,978	$12,320	Belgium-Luxembourg $74,294; Switzerland $53,348.
Industrial, do	$82,047	$142,436	$223	Belgium-Luxembourg $59,665; Mexico $54,823; Ireland $27,680.
Diatomite and other infusorial earth	1,658	1,453	--	United Kingdom 391; Italy 385; France 180.
Feldspar, leucite, nepheline, nepheline syenite	6,989	1,901	--	United Kingdom 1,050; France 716.
Fertilizer materials:				
Crude and manufactured:				
Nitrogenous	311,253	77,752	--	Belgium-Luxembourg 22,503; United Kingdom 19,094; Ireland 14,220.
Phosphatic	17,133	4,107	--	United Kingdom 2,420; Ireland 1,650.
Potassic	404,741	677,503	29,200	Portugal 98,530; Norway 82,103; Brazil 71,400.
Other including mixed	191,892	176,100	--	Venezuela 52,500; Turkey 36,911; Mexico 21,103.
Ammonia	53	39	--	Ghana 18; Mauritania 16.
Fluorspar	193,485	101,546	25,883	Italy 45,398; West Germany 16,311; Netherlands 5,603.
Graphite:				
Natural	1	3	--	Mainly to Pakistan.
Artificial	768	778	--	Portugal 299; Sweden 245; France 203.
Gypsum and plasters	r776	1,111	137	Sweden 262; Denmark 211; Norway 138.
Iodine	2	1	--	Mainly to Cuba.
Lime	6,999	7,776	--	Guinea 3,506; Algeria 2,138.
Magnesite	79,029	93,459	--	West Germany 43,652; United Kingdom 24,209; Netherlands 7,931.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica, all forms	3,048	4,173	--	Mainly to United Kingdom.
Pigments, mineral: Iron oxides, processed	9,652	11,246	846	United Kingdom 1,974; Australia 736; Canada 707.
Precious and semiprecious stones, except diamond:				
Natural ---value	$140,655	$173,810	--	Switzerland $103,553; United Kingdom $50,994.
Synthetic ---do	$479,984	$722,592	$40,328	Switzerland $646,838; France $16,730.
Pyrite (gross weight)	242,302	126,963	(1)	Belgium-Luxembourg 116,930; West Germany 8,007.
Salt and brines	816,357	782,353	229,160	Italy 124,995; Portugal 64,188; Norway 56,151.
Sodium and potassium compounds, n.e.s	90,033	121,373	694	India 24,785; Portugal 15,802; China, mainland 14,987.
Stone, sand and gravel:				
Dimension stone:				
Crude or partly worked:				
Calcareous	26,457	37,239	226	Italy 26,005; France 3,322; Nigeria 3,096.
Slate	1,648	4	--	All to Andorra.
Other	79,765	101,901	--	Italy 75,511; France 18,708; Japan 3,225.
Worked:				
Slate	147,677	172,093	17	France 146,758; West Germany 11,629.
Paving stone and flagstone	48	177	--	France 70; Italy 43; Saudi Arabia 40.
Other	20,133	21,864	278	Saudi Arabia 5,170; France 2,345; Andorra 1,196.
Dolomite	110,304	105,399	--	United Kingdom 64,804; West Germany 31,700.
Gravel and crushed rock	58,085	33,992	--	Morocco 18,124; Andorra 9,487; Liberia 3,399.
Limestone excluding dimension	--	99,434	--	Belgium-Luxembourg 82,312; Benin 17,121.
Quartz and quartzite	224,408	333,698	--	Norway 315,221; Sweden 17,603.
Sand excluding metal-bearing	174,217	385,786	--	Mainly to Andorra.
Sulfur:				
Elemental, all forms	25,953	17,733	--	Turkey 8,964; Algeria 5,901; France 1,891.
Sulfuric acid	112	175	--	France 65; Libya 32; Portugal 28.
Talc, steatite, soapstone, pyrophyllite	6,128	15,030	2,175	West Germany 4,099; Cuba 3,532; United Kingdom 1,887.
Other:				
Crude	508,142	535,133	906	France 185,417; Belgium-Luxembourg 157,232; West Germany 77,087.
Slag, dross, and similar waste, not metal-bearing	74,367	102,208	--	Portugal 48,425; West Germany 32,678; France 10,105.
Oxides and hydroxides of magnesium, strontium, barium	181	394	--	Tunisia 308; Italy 44; Republic of South Africa 22.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	82,630	38,717	1	France 22,547; Iraq 3,538; Nigeria 2,864.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	26	35	--	United Arab Emirates 25; Guinea 10.
Carbon black and gas carbon	5,081	11,577	--	Portugal 3,442; Italy 3,100; France 2,819.
Coal and briquets:				
Anthracite and bituminous coal	r16,238	14,475	--	Belgium-Luxembourg 13,240; France 1,048.
Briquets of anthracite and bituminous coal	157	60	--	Andorra 36; Italy 24.
Lignite and lignite briquets	31	436	--	All to Andorra.
Coke and semicoke	2,048	3,378	--	Italy 2,339; Mexico 1,000.
Hydrogen, helium, rare gases	530	1,418	--	Belgium-Luxembourg 763; Italy 592.
Peat including peat briquets and litter	4	163	--	Libya 121; Portugal 42.

See footnotes at end of table.

Table 2.—Spain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products:				
Crude and partly refined--42-gallon barrels--	--	3	--	Mainly to Italy.
Refinery products:				
Gasoline, including natural thousand 42-gallon barrels--	628	895	--	United Kingdom 314; Argentina 237; Netherlands 182.
Kerosine and jet fuel---------do----	r1,720	530	193	Portugal 213; Netherlands 90; Morocco 33.
Distillate fuel oil ----------do----	4,853	2,087	--	Netherlands 596; Italy 283; Portugal 195.
Residual fuel oil ----------do----	7,177	6,847	478	Netherlands 2,213; Italy 709; Sweden 270.
Lubricants----------do----	r100	51	(1)	Portugal 8; Lebanon 2.
Other:				
Liquefied petroleum gas----do----	30	29	--	Algeria 25; Morocco 3.
Mineral jelly and wax -----do----	6	7	--	France 2; India 2; Morocco 1.
Bitumen and other residues--do----	2,808	3,125	--	Italy 1,479; Libya 624; France 215.
Bituminous mixtures, n.e.s --do----	319	405	--	Libya 154; Nigeria 87; Guinea 46.
Pitch and pitch coke ------do----	78	94	--	France 74; Portugal 10; India 9.
Unspecified ----------do----	r3,516	1,294	21	Taiwan 169; Netherlands 152; Ivory Coast 136.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ----------	19,239	163,272	31,763	Netherlands 54,672; France 35,900; Italy 34,730.

r Revised.
[1]Less than 1/2 unit.
[2]May include waste and sweepings of platinum-group metals.

Table 3.—Spain: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate ----------	117,952	142,818	--	Guyana 57,046; Greece 30,560; Suriname 27,000.
Oxides and hydroxides ----------	432,225	559,226	348	Guinea 267,881; Jamaica 195,958; France 73,624.
Metal including alloys:				
Scrap ----------	3,108	4,080	328	Portugal 3,566.
Unwrought ----------	37,972	7,152	1	France 6,715; United Kingdom 274.
Semimanufactures----------	12,121	14,617	2,810	France 2,590; Belgium-Luxembourg 2,479; United Kingdom 1,345.
Antimony:				
Ore and concentrate----------	564	664	--	Morocco 217; China, mainland 206; Thailand 195.
Metal including alloys, all forms ----------	r127	199	--	Czechoslovakia 105; Belgium-Luxembourg 90.
Arsenic metal including alloys, all forms ------	14	19	1	Sweden 18.
Beryllium metal including alloys, all forms kilograms--	1	10	4	France 3; Japan 2.
Bismuth metal including alloys, all forms------	96	102	--	Mexico 34; Belgium-Luxembourg 20; West Germany 19.
Chromium:				
Chromite ----------	95,597	117,977	--	Albania 53,721; Republic of South Africa 30,218; Turkey 26,333.
Oxides and hydroxides ----------	247	135	1	West Germany 110; U.S.S.R. 13.
Metal including alloys, all forms ----------	r5	6	(1)	United Kingdom 4; West Germany 2.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Cobalt oxides and hydroxides	143	75	1	Belgium-Luxembourg 48; Canada 16.
Copper:				
Ore and concentrate	222,248	191,109	--	Papua-New Guinea 58,963; Peru 46,061; Canada 33,707.
Sulfate	1,130	1,517	--	France 930; Czechoslovakia 300; Israel 198.
Metal including alloys:				
Scrap	11,466	18,951	8,361	France 5,949; Switzerland 1,072; Canada 526.
Unwrought	63,709	64,396	4,718	Chile 24,659; Belgium-Luxembourg 11,654; Republic of South Africa 8,201.
Semimanufactures	17,088	28,146	545	United Kingdom 5,819; France 4,986; West Germany 4,463.
Gold:				
Ore and concentrate kilograms	1,014	350	NA	Papua-New Guinea 244; Canada 55; Republic of South Africa 21.
Waste and sweepings value, thousands	$145,633	$250,768	$8,042	United Kingdom $101,738; Switzerland $87,501; France $52,707.
Metal including alloys, unwrought and partly wrought thousand troy ounces	r353	80	(1)	West Germany 72; France 4.
Iron and steel:				
Ore and concentrate except roasted pyrite thousand tons	r4,628	5,195	1	Brazil 1,359; Venezuela 1,026; Canada 921.
Metal:				
Scrap do	1,950	2,927	1,307	United Kingdom 649; France 414; Netherlands 163.
Pig iron including cast iron	33,785	44,312	--	Canada 18,825; Finland 8,102; Republic of South Africa 7,154.
Sponge iron, powder, shot	6,526	136,600	16	Canada 129,090; Sweden 4,187; France 2,657.
Ferroalloys	34,587	46,557	1,704	Republic of South Africa 26,235; Sweden 6,195; France 5,593.
Steel, primary forms	r295,040	509,314	28	West Germany 136,343; France 77,153; Romania 55,746.
Semimanufactures:				
Bars, rods, angles, shapes, sections	139,525	172,056	1,925	United Kingdom 31,575; France 26,514; Republic of South Africa 22,592.
Universals, plates, sheets	213,489	266,890	1,949	West Germany 88,670; France 52,664; Netherlands 42,581.
Hoop and strip	65,201	66,036	236	France 27,276; West Germany 19,324; Italy 3,922.
Rails and accessories	1,559	2,218	(1)	United Kingdon 1,425; France 500; West Germany 133.
Wire	15,860	19,111	146	France 4,439; Japan 4,362; West Germany 3,305.
Tubes, pipes, fittings	31,130	37,561	2,485	West Germany 14,509; France 8,374; Japan 2,304.
Castings and forgings, rough	3,926	6,274	442	France 2,248; Italy 863; West Germany 839.
Lead:				
Ore and concentrate	33,344	15,155	--	Morocco 13,729; Ireland 1,425.
Oxides	24	109	--	Mainly from Bulgaria.
Metal including alloys:				
Scrap	4,024	286	112	Canada 130; West Germany 15; Andorra 15.
Unwrought	r3,653	1,168	132	France 619; Netherlands 299.
Semimanufactures	141	69	2	West Germany 54; France 9.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate	369,679	487,333	--	Republic of South Africa 194,273; Ghana 92,564; Australia 77,187.
Oxides	670	1,310	15	Belgium-Luxembourg 617; Ireland 560.
Metal including alloys, all forms	r262	351	6	Republic of South Africa 299; West Germany 19.
Mercury 76-pound flasks	23	16	1	Austria 7; West Germany 3; United Kingdom 3.
Molybdenum metal including alloys, all forms	28	32	10	Austria 10; Netherlands 5.
Nickel:				
Matte, speiss, similar materials	r2,654	2,074	10	Canada 1,005; Cuba 859; Norway 99.
Metal including alloys:				
Scrap	--	32	--	All from Netherlands.
Unwrought	6,708	6,500	283	Canada 1,838; Australia 981; Cuba 908.
Semimanufactures	r1,079	721	40	West Germany 256; France 150; United Kingdom 100.
Platinum-group metals including alloys, unwrought and partly wrought troy ounces	43,146	600,672	354	Canada 482,261; Switzerland 87,836.
Rare-earth metals including alloys	29	29	--	Brazil 14; Austria 8; United Kingdom 5.
Selenium, elemental	24	42	1	Japan 10; Canada 10; West Germany 7.
Silicon, elemental	7	45	(1)	Mainly from France.
Silver:				
Ore and concentrate[2]	26	33	10	Morocco 9; Republic of South Africa 8.
Waste and sweepings[2] value, thousands	$24,210	$23,636	$2,104	France $14,645; Switzerland $3,978; United Kingdom $2,281.
Metals including alloys, unwrought and partly wrought thousand troy ounces	2,347	1,993	68	West Germany 699; Belgium-Luxembourg 625; United Kingdom 307.
Tantalum ore and concentrate	31	168	24	Australia 44; West Germany 35; Republic of South Africa 35.
Tellurium, elemental	6	2	--	Peru 1; U.S.S.R. 1.
Tin:				
Ore and concentrate	5,083	3,263	--	United Kingdom 1,345; Thailand 940; Indonesia 576.
Oxides	r368	301	--	West Germany 152; United Kingdom 102; Italy 45.
Metal including alloys, all forms	79	167	2	United Kingdom 72; Malaysia 40.
Titanium:				
Ore and concentrate	106,200	162,977	--	Australia 93,986; Norway 68,986.
Oxides	1,921	2,151	242	Belgium-Luxembourg 679; France 516; West Germany 496.
Tungsten metal including alloys, all forms	17	21	1	France 4; Netherlands 4; Austria 3.
Uranium and thorium metals including alloys, all forms kilograms	431	485	375	France 110.
Vanadium oxides	113	73	--	Finland 70; Republic of South Africa 2.
Zinc:				
Ore and concentrate	89,251	111,703	--	Peru 60,668; Ireland 33,761; Sweden 8,522.
Oxides	526	650	40	West Germany 324; Italy 154; France 121.
Metal including alloys, all forms	1,360	3,265	(1)	West Germany 1,187; Belgium-Luxembourg 841; Mexico 552.
Zirconium:				
Ore and concentrate	20,991	26,526	(1)	Australia 19,119; Republic of South Africa 7,406.
Metal including alloys, all forms	r4	2	(1)	Mainly from France.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates:				
Of molybdenum, tantalum, vanadium, zirconium	4,770	4,802	937	Australia 2,321; United Kingdom 776; Republic of South Africa 325.
Of other base metals	344	1,179	--	Republic of South Africa 640; Australia 398; Burma 121.
Ash and residue containing nonferrous metals	48,796	46,586	16,184	France 5,949; Belgium-Luxembourg 5,643; Norway 2,520.
Oxides, hydroxides, peroxides of metal	r1,923	2,357	300	West Germany 710; France 665; Norway 154.
Metals:				
Alkali and alkaline-earth	181	307	--	West Germany 24; France 80.
Pyrophoric alloys	41	32	(1)	France 24; Denmark 2; United Kingdom 2.
Base metals including alloys, all forms, n.e.s	r369	356	175	Belgium-Luxembourg 73; France 32; Italy 23.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum	1,878	2,365	114	Greece 1,810; France 227; Italy 156.
Artificial corundum	2,848	2,888	139	France 1,134; West Germany 963; Austria 568.
Dust and powder of precious and semiprecious stones value, thousands	$2,908	$3,918	$2,188	Ireland $1,297; United Kingdom $93; Ghana $91.
Grinding and polishing wheels and stones	1,343	1,739	69	Italy 516; France 429; Austria 284.
Asbestos	79,811	74,162	471	Republic of South Africa 32,761; Canada 26,964
Barite and witherite	3,326	2,462	--	Italy 1,804; France 648.
Boron materials:				
Crude natural borates	87,328	113,522	60,320	Turkey 51,100; France 2,102.
Oxides and acid	39	72	15	France 35; Italy 18; United Kingdom 3.
Bromine	47	205	(1)	Israel 173; West Germany 23.
Cement	97,306	246,184	177	Poland 235,840; France 3,803; West Germany 2,954.
Chalk	8,529	10,660	--	France 9,309; United Kingdom 1,202.
Clays and clay products:				
Crude clays:				
Bentonite	28,486	35,277	5,450	Greece 17,815; Morocco 10,940.
Kaolin (china clay)	165,384	172,423	11,339	United Kingdom 127,210; France 13,481; West Germany 12,485.
Other	82,789	76,262	1,079	United Kingdom 54,976; France 12,827; Morocco 3,449.
Products:				
Refractory (including nonclay brick)	r28,751	35,844	1,278	West Germany 9,020; Austria 7,742; Italy 5,900.
Nonrefractory	38,342	75,146	--	Italy 65,286; France 3,682; Portugal 3,101.
Cryolite and chiolite	4,325	9,314	--	Mainly from Denmark.
Diamond:				
Gem, not set or strung value, thousands	$49,948	$40,339	$157	Belgium-Luxembourg $30,162; Israel $2,345; Republic of South Africa $1,733.
Industrial do	$1,842	$2,506	$10	Republic of South Africa $1,638; Zaire $266; Netherlands $255.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diatomite and other infusorial earth	3,127	2,998	1,624	France 1,193.
Feldspar	15,212	16,256	--	France 12,977; Norway 1,570; Republic of South Africa 792.
Fertilizer materials:				
Crude:				
Nitrogenous	26,695	46,667	--	Mainly from Chile.
Phosphatic thousand tons	2,960	2,932	40	Morocco 2,824; Togo 55.
Other including mixed	4,036	3,011	(1)	France 2,703; Netherlands 283.
Manufactured:				
Nitrogenous	78,151	181,394	(1)	Netherlands 74,948; West Germany 39,758; Norway 24,728.
Phosphatic	9,835	15,552	--	Belgium-Luxembourg 11,543; France 1,155; Israel 1,000.
Potassic	r1,252	3,117	--	Mainly from Israel.
Other including mixed	22,429	121,047	92,022	West Germany 7,061; Finland 7,037; Netherlands 5,890.
Ammonia	295,813	337,647	97,913	Mexico 91,079; Ireland 43,896; Libya 33,337.
Fluorine, elemental	--	9,997	9,957	France 39.
Fluorspar	8	23	--	Italy 16; West Germany 5; France 2.
Graphite:				
Natural	1,484	1,778	5	Madagascar 575; Italy 387; West Germany 295.
Artificial and colloidal	2,396	3,648	797	Italy 947; France 848; United Kingdom 626.
Gypsum and plasters	6,748	6,573	17	France 5,577; Morocco 543.
Iodine	105	146	--	Japan 128; Chile 18.
Lime	119	87	--	France 73; West Germany 11.
Magnesite	49,080	53,832	56	Greece 24,950; Italy 17,842; United Kingdom 4,821.
Mica, all forms	952	1,189	85	Austria 288; India 202; Republic of South Africa 195.
Pigments, mineral: Iron oxides including processed	6,136	7,350	39	West Germany 5,949; France 447; United Kingdom 378.
Precious and semiprecious stones except diamond:				
Natural value, thousands	$10,423	$8,111	$29	Thailand $2,524; Belgium-Luxembourg $1,262; India $1,104.
Synthetic do.	r$895	$1,536	$90	Ireland $523; Austria $493; Switzerland $170.
Pyrite (gross weight)	120	160	10	Italy 87; Austria 50.
Salt and brine	2,236	1,262	5	Netherlands 610; United Kingdom 557.
Sodium and potassium compounds, n.e.s	107,675	147,447	1	France 82,311; West Germany 31,861; United Kingdom 14,886.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	97,236	91,780	--	Italy 60,180; Portugal 29,200.
Slate	6	3	--	All from Andorra.
Other	27,460	27,743	--	Finland 8,049; Norway 6,013; Republic of South Africa 3,935.
Worked:				
Slate	194	155	--	Italy 131; France 23.
Paving stone and flagstone	190	104	--	Italy 78; Belgium-Luxembourg 24.
Other	8,611	12,783	19	Italy 8,950; Portugal 3,216.
Dolomite, chiefly refractory grade	3,563	3,121	--	France 2,457; Norway 660.
Gravel and crushed rock	20,821	29,185	--	Morocco 22,853; France 6,130.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Quartz and quartzite	5,910	2,617	(1)	Sweden 1,380; Yugoslavia 625; Belgium-Luxembourg 325.
Sand excluding metal-bearing	16,171	14,692	22	Morocco 7,799; France 4,954; Belgium-Luxembourg 1,663.
Sulfur:				
Elemental:				
Other than colloidal	124,651	109,576	--	France 80,283; Mexico 28,992.
Colloidal	133	6,382	55	West Germany 6,324.
Sulfuric acid	416,826	251,486	43	West Germany 104,301; France 38,404; United Kingdom 37,219.
Talc, steatite, soapstone, pyrophyllite	11,980	10,970	73	France 8,508; Norway 1,131; Belgium-Luxembourg 399.
Other:				
Crude	73,060	47,787	112	U.S.S.R. 17,720; Morocco 9,791; Greece 6,462.
Slag, dross, and similar waste, not metal-bearing	1,960	6,230	6	France 2,747; West Germany 1,687; Italy 1,566.
Oxides and hydroxides of strontium, magnesium, barium	211	160	2	France 83; West Germany 26; Ireland 18.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s.	4,030	4,329	(1)	France 2,342; Italy 642; United Kingdom 351.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,087	407	291	United Kingdom 100.
Carbon black and gas carbon	16,359	18,511	926	France 13,429; Netherlands 1,504; West Germany 1,108.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	3,377	4,192	1,313	Poland 1,460; Australia 709; U.S.S.R. 215.
Briquets of anthracite and bituminous coal	10	31	--	Netherlands 24; United Kingdom 7.
Lignite and lignite briquets	6,391	7,086	--	France 7,044; Sweden 42.
Coke and semicoke	247,636	547,845	81,146	Poland 161,202; Italy 82,968; West Germany 66,060.
Gas, natural million cubic feet	55,820	64,109	--	Libya 45,701; Algeria 18,046.
Hydrogen, helium, rare gases	148	74	4	United Kingdom 68.
Peat including briquets and litter	9,726	8,798	--	West Germany 5,795; U.S.S.R. 1,044; Finland 712.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	354,202	360,037	--	Saudi Arabia 127,660; Iraq 51,633; Libya 36,245.
Refinery products:				
Gasoline including natural do.	69	3,759	(1)	Netherlands 2,168; Italy 1,068.
Kerosine and jet fuel do.	2	1,491	--	Israel 711; Italy 430; East Germany 186.
Distillate fuel oil do.	1,284	1,895	(1)	Italy 1,000; U.S.S.R. 170; Iran 133.
Residual fuel oil do.	3,845	3,321	--	France 825; Italy 405; Syria 386.
Lubricants do.	r161	213	10	France 64; United Kingdom 56; Netherlands 29.
Other:				
Liquefied petroleum gas do.	r12,601	14,067	(1)	France 4,069; Saudi Arabia 2,883; Algeria 1,937.
White spirit do.	17	27	(1)	France 20; Belgium-Luxembourg 7.
Mineral jelly and wax do.	34	30	3	France 9; Netherlands 5; West Germany 5.
Petroleum coke do.	1,785	3,002	2,240	United Kingdom 316; U.S.S.R. 215; West Germany 122.

See footnotes at end of table.

Table 3.—Spain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum and refinery products —Continued				
Refinery products —Continued				
Other —Continued				
Bitumen and other residues thousand 42-gallon barrels	16	30	14	United Kingdom 14.
Bituminous mixtures, n.e.s ___do___	6	6	1	United Kingdom 2; West Germany 1; Sweden 1.
Pitch and pitch coke ___do___	298	285	--	West Germany 239; United Kingdom 40.
Unspecified ___do___	r2,198	3,283	206	France 488; Italy 431; Pakistan 426.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	143,171	142,167	119,932	West Germany 6,467; France 5,161; Netherlands 4,226.

rRevised. NA Not available.
[1]Less than 1/2 unit.
[2]May include platinum-group metals.

COMMODITY REVIEW

METALS

Aluminum.—Although almost completely dependent on imported bauxite, Spain continued to develop its aluminum industry. During 1980, completion of the first alumina plant in Spain at San Ciprian, Province of Lugo, ended construction of the alumina-aluminum complex there, which is the largest aluminum producing installation in Spain. In addition to the 800,000-ton-per-year alumina plant owned by Alumina Espanola S.A., the new complex incorporated a 180,000-ton-per-year aluminum plant owned by Alumino Espanol S.A., all necessary ancillary installations, and a seaport capable of handling vessels up to 60,000 tons. The alumina plant at San Ciprian used the traditional Bayer process, and produced anhydrous alumina. Alumina is stored in two 25,000-ton silos. The red mud is treated by the dry process developed by Giulini Krauss Maffei. This process was in use at the alumina plant near Ludwigshafen in the Federal Republic of Germany. Capacity of the plant can be expanded to 2.4 million tons of alumina per year without difficulties.

The smelter capacity of San Ciprian was derived from two 90,000-ton-per-year potlines, each having 265 cells. The smelter process is computer controlled, with technology by Aluminium Pechiney S.A. Provisions have been made to expand capacity by adding a third 90,000-ton-per-year potline. Power comes from a lignite-burning powerplant at Puentes de Garcia Rodriguez, about 40 kilometers southwest of San Ciprian.

The smelter was designed to protect the environment as much as possible. Gases from the smelter are treated before release into the atmosphere. The collected "rich gas" is circulated in a gas treatment installation countercurrent with an alumina stream. Alumina absorbs fluoride from gases and is fed to the pots. The air from the pot room is treated in 64 wet scrubbing towers and is exchanged 18 times per hour.

The startup of the smelter was delayed because of strong objections by environmentalists fearing damage from fluoride emissions. However, an investigation carried out by the Spanish authorities found the emissions from the San Ciprian aluminum smelter to be within permissible limits.

Total employment, at both installations, was reported at 2,000 persons. With completion of the San Ciprian facilities, Spain became self-sufficient in alumina and aluminum, and the size of aluminum-producing capacities placed Spain among the leading aluminum producers in Europe. During 1980, the following aluminum smelting installations were in operation:

Name	Company	Capacity in thousand tons per year
La Coruna	Aluminio de Galicia S.A.	78
Aviles	Endasa S.A. (Government).	101
Valladolid	do	25
Sabinanigo	Aluminio de Galicia S.A.	14
San Ciprian	Aluminio Espanol S.A	180
Total		398

Copper.—RTZ, which holds 25% of capital in RTM, acquired an additional 24%, at a cost of 2,850 million pesetas, equivalent to US$41 million.[2]

After this latest financial transaction the Union Explosivos Rio Tinto S.A.'s (UERT) share of RTZ was 51% and that of RTM was 49%. During 1980, RTM was near completion of a program that should bring company copper output to the level of 50,000 tons per year by the end of 1981. At the Huelva copper smelter, owned by RTM, the largest copper smelter and refinery in Spain, new pollution control equipment has been added to the existing facilities.

Two major producers of secondary copper, Cobre Electrico Metales, S.A., and Industries Reunidas Minero Metalurgicas S.A., were preparing to merge during 1980, but final agreement was not announced during the year.

Gold.—During 1980, the Rodalquilar (Almeria) gold mine was the site of stepped-up exploration. Higher gold prices made future production from Rodalquilar, closed since 1966, far more attractive than in the past. In addition, a number of prospecting permits for precious metals were requested for exploration in the Rioja area in northern Spain, mostly in abandoned mines.

Most of the production of gold in Spain, about 90% of the country's total, comes from copper mining operations of Rio Tinto Minera S.A. in Huelva Province, southern Spain. In addition, some gold was recovered by Metal Química del Nervion S.A. from pyrite cinder at its installations at Axpe-Erandio, Bilbao, in northern Spain.

Iron and Steel.—Exploration for iron ore by the Instituto Geologico Minero de Espana (IGME) at the localities of Cala Teulera (Huelva), San Guillermo-Colmenar, Santa Justa, and La Berrona, all in Badajoz Province, located significant reserves of iron ore. Reserves of all categories in the area were estimated at 150 million tons of ore, mostly magnetite with an average metal content of 30% to 40% iron.

Based on preliminary results, the largest reserves were at the deposits shown in the following tabulation, in million metric tons:

Deposits	Reserves	
	Proven	Others
Cala-Teuler-San Guillermo	27	51
Justa	21	NA
La Berrona	22	NA

NA Not available.

The IGME's experts believe more iron can be found by further exploration.

Based on these new reserves, a project for construction of a pelletizing plant located at Fregenal de la Sierra and one for a direct-reduction (DR) plant at Huelva, were prepared, but the actual construction awaited the approval of the Government. Both plants were planned to use recently discovered natural gas from the Gulf of Cadiz.

Prereducidos del Suroeste de Espana S.A. (Presursa) was formally constituted in Madrid, to own and operate Spain's first DR plant. Presursa announced plans to construct a two-module DR plant, but selection of technology to be used was not announced by yearend. Empresa Nacional Siderurgica S.A. (Ensidesa), the major steel producer in Spain, started to test its new wire-rod mill at Verina Works. The mill was rated at 450,000 tons of wire rods (diameter 5.5 to 12.5 millimeters). The mill is computer controlled, and there is a Stelmore-controlled cooling system.

Ensidesa announced plans to close its 150,000-ton-per-year plate mill at La Felgriera Works in Austurias by the end of June 1980.

A new program of revitalization of the Spanish steel industry prepared by the Ministry of Industry provided for 3-year financial aid, ending in 1981, of 139,000 million pesetas (US$1,985 million). The social pact, part of the program between the workers of steel companies, included the renunciation of strikes, reduction of absenteeism, and a freeze of wages in 1981, with a rise of 3% and 4% in 1982 and 1983, respectively.

The Spanish steel industry had heavy losses during 1980. A report published by the Spanish Government states that facilities of the industry are, in general, in a satisfactory competitive position except for the sinter plants at Aviles, open-hearth

shop at Aviles, the plate mill at Meres, and the integrated works at Sagunto.

In general, productivity figures for Spanish integrated steel plants are about 82% of the average figure achieved in the steel plant of the European Communities (EC).

The nonintegrated steel sector in Spain had about 33 companies in operation at the beginning of 1980. Roughly 34% of the total country steel capacity, 51% of total rolling capacity, and 76% of round bar capacity was operated by the nonintegrated steel sector. Raw materials supply was a problem. Scrap was imported from EC countries, Eastern Europe, and the United States. Imports from the EC and Eastern Europe are limited to some extent by Government control and from the United States by the limited number of suppliers.

It was suggested that the use of direct reduction be studied as a solution for scrap shortages; centralized purchasing of scrap was mentioned as another possibility for alleviating scrap shortages. In general, the nonintegrated sector, highly dispersed, could improve its economic position by coordinating development of new capacities and by avoiding expansion of already existing facilities, and by switching from investments in rolled steel to investments in production of steel ingots.

Lead.—Exploracion Minera International, Espana S.A., continued to develop its property at La Troya, near Rubiales in northern Spain. Mine production was planned for 1981, and output should reach 6,000 tons of metal in ore. During 1980, Andalusa de Piritas S.A. produced about 21,000 tons of lead in ore at its mine in Aznalcollar, about 40 kilometers by road, northwest of Seville.

According to a report prepared by Centro National de Investigaciones Metalurgicas, Madrid, and Associacion Nacional del Plomo, a new lead smelter may be constructed before the end of 1985. With this new smelter, domestic capacity would reach 120,000 tons of lead per year. The location was not mentioned, but it appeared that it may be in the general area of Seville because the new smelter would treat lead concentrates from mines producing and treating complex sulfide ores in southern Spain. At yearend 1980, the total lead smelter capacity of two smelter operations in Spain was 105,000 tons. The largest was Penarroya's Santa Lucia smelter at Cartagena, capacity of 65,000 tons of refined lead and 5,000 tons of lead alloys; the second smelter was at Lineares, Jaéen Province, with a capacity of 40,000 tons of lead and 10,000 of lead alloys owned by the Cía. La Cruz. During past years, Spain was about 25% dependent on imported lead concentrates to meet its lead smelter demand.

Mercury.—In late 1980, the Spanish parliament passed a bill which transformed the Consejo de Administration de Minas de Almaden Arrayanes from a department of the Ministry of Finance to a Government-owned company. The new company will administer the Almaden mining complex and supervise the general development of the Almaden region. The new law also stipulated that the Government approve a contract regulating relations between the state and the new company.

The El Entredicho mercury opencast mine, located about 5 kilometers southwest of Almaden, went onstream during 1980. Reportedly the El Entredicho Mine was the cheapest mercury producer in the world, and it contained the largest reserves and highest metal content of any mercury deposit in the world.

Pyrite.—The development of Sotiel Mine, Province of Huelva, southern Spain, and construction of a 600,000-ton-per-year complex ore flotation plant nearby, continued during 1980. Management of the Government-owned Minas de Almagrera S.A., which owns the facilities, expected production to start sometime late in 1981 or in 1982.

The Aprovechiamento Integral de Pyritas S.A., a company which was organized by UERT, Compañía de Azufre Cobre Tharsis S.A., and Metal Química del Nervion S.A. for recovery of lead, zinc, copper, and silver from pyrite cinders, underwent a financial rearrangement. UERT increased its holdings in the venture, Compañía de Azufre Cobre Tharsis S.A. lost some holdings, and Fosforica Espanola S.A. joined the venture.

Strontium.—A new strontium compound plant, with an annual capacity of about 1,500 to 2,000 tons of strontium carbonate, was under construction during 1980 near the Port of Motril in Granada, in southern Spain. The plant, operated by Promisura S.A., was supplied principally by the Montevive Mine near Granada, about 70 kilometers away. The mine was modernized recently to produce about 40,000 tons per year of ore. Most of the output was 2- to 4-inch lump material containing about 94% Sr SO_4. Reportedly, reserves are between 2 and

3 million tons of celestite.

Tin.—During 1980, the refurbishing of the washing plant at the tin mine at Serradilla in Cáceres Province increased the plant's throughput capacity from 350 to 1,000 tons of ore per day. During the year, the owner, Astruminera S.A., was evaluating the economics of the operation.

Tin in Spain was produced from tin operations and from tungsten-tin operations. Tin alone was produced by 14 producers; the Province of Salamanca, with 4 producers, produced about 55% of the total.

Two tin smelter companies merged during 1980, when MESAG S.A. acquired all the shares in Electrometalurgica del Agueda, a company owned by Portugese interests. MESAG S.A. had a tin smelter and ferroalloy-producing facilities at Villa Irabo, Province of Zamora.

NONMETALS

Barite.—The barite mines in Cordoba Province owned by Coto Minero Nacional Carbonell were taken over by Minas de Baritina S.A. Details of the financial arrangements were not made public.

Kaolin.—A plant for the treatment of kaolin was planned based on the deposit at Molina de Aragon (Gudalajara). The new plant should produce good-quality kaolin, which in the past was imported. The size of the plant and ore reserves were not published.

Potash.—Potasas de Navarra S.A., a member of the state-owned INI group, announced its intention to slow down and close the mine to cut losses unless labor union demands become more reasonable, but negotiations apparently resolved some of the problems.

Salt.—During exploratory drillings for oil in the Province of Huelva, three wells—Almonte, Asperillo, and Moguer—encountered a 400-meter thick salt formation starting at 800 meters. The Triassic formation dips west and extends into Portugal, where salt is produced by underground mining at Olhao. The Government of Spain has rented one block to each of the following companies: UERT, Dow Chemical Iberica S.A., and Energia y Industria Aragonesas S.A. Apparently, salt will be produced by hydrofracturing and controlled dissolution. Cía Andaluz de Sal proposed to exploit the Adelina and Martre concession in Huelva by solution mining.

MINERAL FUELS

During 1980, Spain remained heavily dependent on energy imports (about 70%) and was particularly dependent on oil, which accounted for about two-thirds of primary energy demand. The only sizable domestic energy resources were solid fuels and hydropower, which provided about 87% of the total domestic production.

Coal.—As in the past, coal remained the principal fuel produced in the country. Production of coal and lignite increased significantly during 1980, and coal imports followed the production with an upward trend, indicating that efforts of the Government to reduce dependence on liquid hydrocarbons and to switch to coal started to produce results.

During 1980, exploration for coal conducted by the Empresa Nacional Adaro near Granada resulted in discovery of one lignite deposit at Arenas del Rey and a peat deposit at Padul.

At Arenas del Rey, proven reserves were reported at 53.9 million tons of lignite, with a calorific value of 2,060 kilocalories per kilogram with humidity 40%. Of the total, 39 million may be mined by opencast mining (with a ratio of 10 cubic meters of overburden to 1 ton of lignite). Future employment at this mine should be 375 persons.

The peat deposit at Padul has proven reserves of 41 million tons of peat, with a calorific value of 1,400 kilocalories per kilogram. A future peat operation could provide employment for 106 persons. By yearend, no decision had been made in regard to the future of these two deposits.

The largest coal producer in the country was Empresa Nacional Hulleras del Norte S.A. (Hunosa). Hunosa was created to encompass various private coal-producing companies in Asturias, and assure control of the operation to the Government through the INI. Hunosa produced about 4.5 million tons of coal annually from underground mines and 0.5 million from opencast mines. During 1980, its production was concentrated in nine large mining operations and five large coal washeries, with a total capacity of 10 million tons of run-of-mine coal. Three deposits—Coto Belo, San Victor, and Nicolosa—were mined by opencast methods. Equipment at these mines had the capacity to move 12 million tons of material per year.

Natural Gas and Petroleum.—Onshore and offshore exploration continued, but no major discoveries were made public during 1980. Production tests run on the well, Serrablo-3, in the Serrablo Field, Province of Huesca, indicated the existence of a gas

deposit at depths between 1,600 and 2,000 meters. According to a representative of the Compañía Arrendataria del Monopolio de Petroleos S.A., reserves of natural gas in the Gulf of Cadiz are equivalent to 6 million tons of crude oil, and six out of eight wells were ready for production.

At the beginning of 1980, 10 refineries were operational in Spain, having a total capacity of 76 million tons of crude per year. About 48 million tons of crude were processed during 1980 and refineries employed around 9,000 persons. Petrleos Mexicanos (Pemex), the Mexican Government petroleum company, acquired from Campsa 15% of the capital of Refineria de Petroleos del Norte (Petronor), with an option to buy another 19% within 1 year. Petronor operated a 10-million-ton-per-year refinery at Somorrostro, near Bilbao.

Uranium.—According to reports published in the local press, a substantial uranium deposit was discovered in the area of Tavertet and Vilanova de Sau (Barcelona Province). No details were given on quality and size of reserves.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Spanish pesetas (Ptas) to U.S. dollars at the rate of Ptas70 = US$1.00.

The Mineral Industry of Sudan

By E. Shekarchi[1]

Efforts have been made over a 50-year period to discover major ore deposits in Sudan; however, the mining industry remained practically primitive. In 1980, as in previous years, essentially the only activity consisted of small-scale exploitation of a few ancient gold mines and production of chromite, manganese ore, salt, and mica. Since 1949, cement has been manufactured in the country. The most significant event of 1980 was the discovery of petroleum 170 kilometers southeast of Gabra at a depth of 9,000 feet, with a total flow of 11,000 barrels per day. Exploration programs to confirm the configuration of the new discoveries were underway, and a plan for active petroleum exploration by 1982 was discussed by Government officials. A committee was set up to study the consumption of petroleum fuels in the country, with the aim of attaining self-sufficiency in energy. In 1980, the cost of oil imports to Sudan exceeded $300 million. Total export during 1980 amounted to $750 million, whereas the imports were at about $1.8 billion. Contribution of the mining industry, with exports of about 23,000 tons of chromite, remained negligible.

Completed in the latter half of 1980, the Port Sudan—Khartoum road was carrying half of the port's cargo. Vitally important and politically sensitive imports of wheat, flour, sugar, and general cargo were transported mainly by this road. The Port Sudan operation, managed by the Sea Ports Corp. (SPC) of the Ministry of Transportation, was improved substantially a year or 2 ago. The improvements were part of World Bank Part 1 project, which was scheduled for completion in October 1981. New cargo handling equipment and 42 new forklifts were already in use in 1980, and new berthing facilities for container and roll-on and roll-off cargo was expected to be completed in 1981. SPC was pushing plans to build a new port in Suakin, 40 kilometers south of Port Sudan. The first stage of construction of a breakwater and four berths, two for container vessels and two for ships, with roll-on and roll-off capabilities, was scheduled to start in 1982. Saudi sources were to provide $200 million for major facilities, while the Federal Republic of Germany was to supply $80 million for associated infrastructure. Work being considered for the latter stages included the construction of tanker and bulk terminals. Should Sudan develop an oil export capability, Suakin would be the terminus of a pipeline from the oilfields.

Even though Sudan's overseas workers provided $350 million as a net foreign exchange income, the flow of skilled workers and managers to nearby labor-hungry Persian Gulf Oil producing nations remained a critical work force problem for the country. It was expected that with development of oilfields, refinery construction, and pipeline building, many of the expatriates may be persuaded to return to Sudan and help restore the economy of the country. A radical new financial and currency exchange control measure was introduced in early 1980 to boost the general economy and to handle export-import currencies. The main consequences of the measure were to lift a battery of controls on the import and export of foreign currency; to establish a two-tier exchange system with an official rate of 50 piasters per dollar (for essential commodities), and a parallel rate of 80 piasters for all other transactions (including repatriation of Sudanese expatriate's earnings and all foreign business persons and tourist's currency dealings); and finally, to

abolish the much-abused nil value import license system, whereby Sudanese nationals working abroad could obtain permission to finance imports or finance international barter trade.

The conflict between Iran and Iraq indirectly affected Sudan's petroleum supply. Iraq suddenly suspended its 5-year crude supply agreement with Sudan in the latter part of 1979. However, Sudan was able to conclude an agreement with Saudi Arabia for importing an additional 1.2 million tons of crude oil. Moreover, Kuwait agreed to increase its exports of refined products to Sudan by 300,000 tons per year over and above the 400,000 tons per year, which it had been supplying in the past.

Table 1.—Sudan: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
Cement, hydraulic thousand tons	130	137	171	184	[3]185
Chromium: Chromite concentrate, gross weight	21,873	17,273	18,000	28,176	[3]25,000
Gold, mine output, metal content[e] troy ounces	300	300	300	300	300
Gypsum and anhydrite, crude	[e]18,000	[e]15,300	[e]20,000	10,000	[3]10,000
Manganese ore	458	457	450	450	400
Mica, all grades	550	[e]400	1,000	2,000	1,500
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	1,022	1,170	1,211	1,200	1,200
Jet fuel do	390	275	199	199	192
Kerosine do	285	267	193	192	200
Distillate fuel oil do	2,348	2,440	3,653	3,700	3,600
Residual fuel oil do	3,174	3,347	1,858	1,900	1,850
Other do	135	42	52	60	70
Refinery fuel and losses do	640	362	350	350	300
Total do	7,994	7,903	7,516	7,601	7,412
Salt	70,000	91,713	72,000	81,200	80,000

[e]Estimated. [p]Preliminary.

[1]Table includes data available through July 10, 1981.

[2]In addition to the commodities listed, modest quantities of a variety of crude construction materials (including clays, stone, and sand and gravel) presumably were produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels. Crude oil was produced from several wells on a testing basis but was not being produced for domestic use or export through yearend 1980.

[3]Reported figure.

Table 2.—Sudan: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
Copper metal including alloys, scrap	50	160	Japan 100; Netherlands 60.
Iron and steel metal, scrap	--	4,547	All to Egypt.
Lead metal including alloys, scrap	297	661	Egypt 500; Denmark 106.
Zinc metal including alloys, scrap	--	70	All to Netherlands.
Other:			
Ores and concentrates of base metals, n.e.s	9,000	24,376	Switzerland 14,906; Netherlands 9,470.
Nonferrous metal scrap, n.e.s	--	50	All to Japan.
Abrasives: Dust and powder of precious and semi-precious stones	--	211	All to India.
Fertilizers, crude	400	--	
Pigments, mineral, natural	1,300	--	
Salt	241	148	Zaire 75; Ethiopia 55; Congo 18.
Sodium carbonate, natural	400	10	All to Saudi Arabia.
Petroleum refinery products: Lubricants thousand 42-gallon barrels	109	1,421	Greece 945; Italy 140; Cyprus 133.

Table 3.—Sudan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide	354	--		
Metal including alloys, unwrought and semimanufactures	1,176	1,326	(1)	Hong Kong 519; France 218; Yugoslavia 158.
Copper metal including alloys, semimanufactures	113	58	(1)	United Kingdom 43; West Germany 6.
Iron and steel metal including alloys:				
Pig iron, ferroalloys, similar materials	8	1	--	All from West Germany.
Steel, primary forms	7,472	9,361	--	Japan 3,814; Portugal 2,059; Brazil 1,818.
Semimanufactures:				
Bars, rods, angles, shapes, sections	20,671	14,722	--	Belgium 4,734; Japan 2,049; Italy 1,651.
Universals, plates, sheets	21,399	14,208	147	Japan 6,814; Belgium 4,028.
Hoop and strip	39,860	5,526	--	Belgium 2,406; West Germany 1,988; Netherlands 908.
Rails and accessories	--	4	--	All from United Kingdom.
Wire	941	1,815	--	West Germany 1,195; Belgium 517.
Tubes, pipes, fittings	1,209	9,083	23	Taiwan 3,500; Japan 2,199; Egypt 1,631.
Castings and forgings, rough	300	734	--	Japan 362; Hong Kong 282.
Lead metal including alloys, unwrought and semimanufactures	975	673	--	Italy 648; United Kingdom 17.
Manganese ore and concentrates	1,700	715	--	All from Singapore.
Nickel metal including alloys, unwrought and semimanufactures	4	5	--	Mainly from West Germany.
Silver metal troy ounces	1,061	--		
Tin metal including alloys, unwrought and semimanufactures	NA	2	--	Mainly from Belgium.
Zinc metal including alloys, unwrought and semimanufactures	NA	971	--	Netherlands 442; West Germany 305; Belgium 215.
Other:				
Ores and concentrates, n.e.s	1	--		
Oxides of lead and zinc, not separated	283	32	--	West Germany 20; India 12.
Oxides of manganese, iron, cobalt, and titanium, not separated	510	245	--	China, mainland 110; West Germany 67; United Kingdom 44.
Oxides, hydroxides, peroxides of metals, n.e.s	97	168	--	United Kingdom 114; Belgium 45.
Base metals including alloys, all forms, n.e.s	NA	(1)	--	All from Belgium.
NONMETALS				
Abrasives, n.e.s.:				
Dust and powder of precious and semiprecious stones	49	--		
Grinding and polishing wheels and stones	406	56	--	West Germany 32; India 10; Italy 8.
Asbestos value	--	$81,162	--	All from West Germany.
Cement	151,296	62,475	--	Italy 18,234; Spain 11,033; Poland 10,000.
Chalk	184	--		
Clays and clay products including all refractory brick:				
Crude	51	143	--	West Germany 99; United Kingdom 26; India 10.
Products:				
Refractory (including nonclay brick)	488	894	4	Greece 651; Egypt 93.
Nonrefractory	2,395	1,081	--	Italy 817; Romania 70.
Fertilizer materials:				
Crude, phosphatic	6	--		
Manufactured:				
Nitrogenous	2,351	73,594	--	Kuwait 73,462.
Phosphatic	126	155	--	Belgium 121; India 19; Netherlands 15.
Other including mixed	--	4	--	All from Kenya.
Ammonia	19	13	--	West Germany 11; United Kingdom 2.
Graphite, natural	14	1	--	All from West Germany.
Gypsum and plasters	--	147	--	West Germany 76; Belgium 71.
Lime	36	3,612	--	Italy 3,484; West Germany 115; United Kingdom 13.
Mica, crude, including splittings and waste	27	--		
Pigments, mineral, natural, crude	51,547	3,700	--	All from West Germany.
Salt	--	1	--	All from New Zealand.
Sodium carbonate	--	11,660	--	All from Chad.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	4,693	3,590	20	West Germany 884; Netherlands 842; Spain 699.
Caustic potash and sodic and potassic peroxides	36	44	--	Netherlands 25; Republic of South Africa 11.

See footnotes at end of table.

Table 3.—Sudan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel:				
Dimension stone ---------- value	$608	--		
Sand excluding metal-bearing ----------	44	--		
Sulfur:				
Elemental, all forms ----------	15	10	--	Mainly from Belgium.
Sulfuric acid ----------	874	615	(1)	West Germany 243; Netherlands 166; Belgium 108.
Other nonmetals, n.e.s:				
Crude ----------	--	52	--	West Germany 45; Belgium 7.
Bromine, chloride, fluorine ----------	109	--		
Building materials of asphalt, asbestos, fiber cements, and unfired nonmetals, n.e.s ----------	1,250	999	--	West Germany 732; United Kingdom 196.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural ----------	2,224	11,514	--	Italy 11,058; Singapore 436; West Germany 11.
Carbon black ----------	130	72	(1)	West Germany 44; Netherlands 26.
Coke and semicoke ----------	10	48	--	All from United Kingdom.
Oxygen, nitrogen, hydrogen, rare gases ----	2	6	--	Mainly from Netherlands.
Petroleum refinery products:				
Gasoline:				
Motor - thousand 42-gallon barrels	49	157	--	NA.
Aviation ---------- do	21	94	--	NA.
Kerosine ---------- do	56	105	--	NA.
Distillate fuel oil ---------- do	154	112	--	NA.
Residual fuel oil ---------- do	9	(1)	--	All from Kenya.
Lubricants ---------- do	137	94	4	NA.
Other:				
Liquefied petroleum gas ---- do	--	(1)	--	All from France.
Mineral jelly and wax ---- do	2	2	--	Mainly from West Germany.
Bituminous mixtures, n.e.s -- do	10	83	--	Singapore 74; China, mainland 7.
Unspecified ---------- do	--	66	--	All from France.
Total ---------- do	438	713		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ----------	26	--		

NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Chromite.—Chromite production from the Ingessana Hills in the southeast of the Blue Nile Province was reported at 25,000 tons in 1980. The deposits were mined by the Government-owned Ingessana Hills Mine Corp. and the privately owned Blue Nile Chromium Ltd. A feasibility study by Mitsubishi, in partnership with Japanese Metals and Chemical Co., on the erection of a ferrochrome plant with a 50,000-ton-per-year capacity was completed in 1980, but final discussions on the construction were postponed. The original plan called for construction of the ferrochrome plant on the mine site at a cost of $50 million, and export of ferrochrome to Japan in a prearranged barter agreement. No firm date for construction was given by the end of 1980. The lack of proven chromite reserves in the entire country seemed to be the main reason that outside investors were uninterested. The Geological and Mineral Resources Department (GMRD) of Sudan identified two new chromite occurrences during the year—in Sol Hamed, 35 kilometers northwest of Halaib village, and in the western part of the Devaheib area. Exports of chromite were mostly to Japan and Western European nations in 1980.

Gold.—Because of the high prices for gold on the international market, local small operators, mostly family-type operations,

flourished during 1980. Official figures of these operators were not available by yearend. Most of the gold mineralization occurred along the Nile River and the northern parts of the Red Sea Hills. In a publication entitled "The Geology and Mineral Occurrences of the Red Sea Hills" prepared in 1979, GMRD of Sudan has shown the location of seven gold-producing mines in this area. No firm decision on a joint venture between a British firm, Robertson International, and Sudan Government to mine gold along the Red Sea Hills was reached during the year.

Iron Ore.—The iron ore occurrences previously known, and those located during the regional aeromagnetic survey of the Red Sea Hill area (1971-77) were listed at 20 in a published report by GMRD during 1980. Total reserves of these deposits and occurrences were given at 500 million tons. Those estimates and calculations were provided by various geological teams working in the country, including Japanese and Soviet teams. Discussions between the Sudanese Government and Arab Mining Co., concerning funding for iron ore mining and beneficiation, continued during the year. Even though preliminary agreements were reached, the size of the investment and production ceiling was not made public by yearend.

Manganese.—Detailed systematic investigations, including a geological and geophysical survey and drilling to find the extent and occurrence of manganese mineralization in Sudan, was completed by 1979, and reportedly 37 manganese occurrences and deposits have been found. Twenty-three of the occurrences were located in the coastal sediments, while the other 14 occurred in the rocks of the basement complex. None of the reported deposits was evaluated for contained reserves, although some were chemically analyzed. The manganese grade ranged from 23% to 53% Mn. Mining of manganese remained on a local level, and primarily hand sorting was used to upgrade the ore.

Uranium.—According to directives from GMRD, the exploration effort to map uranium-bearing rocks in the country by various private overseas companies has been successful. The Ministry of Energy and Mining began negotiations with several foreign firms for evaluating the ores and for more detailed geological work. Apparently more exploration permits were issued during the year, but no exploitation agreements were in sight.

NONMETALS

Asbestos.—Development work on the asbestos mining by a company jointly owned by Johns-Manville of Canada, Gulf International Group of Kuwait, and the Goverment of Sudan, continued during 1979. Most of the development work was on the mill and infrastructure section. When in operation, the mining would be underground, and the material would be processed in a plant with 100,000 tons of fiber capacity.

Cement.—The second renovation phase of Nile Cement Co.'s Rahak plant was completed during 1980. Installation of a 150-ton-per-hour crusher, which replaced the old 40-ton-per-hour crusher, resulted in a new record high production, about 80,000 tons, for the cement plant. Also the purchase of 12 new haulage vehicles made transportation of feed material, about 60 kilometers from quarry to plant, a reality in 1980. This plant was able to supply the cement requirements of most of the east Nile area and was operational during the entire year, rather than being closed the usual 4 months due to road conditions and lack of feed material.

MINERAL FUELS

Petroleum.—Encouraging petroleum discoveries were made by the U.S. company, Chevron Overseas Petroleum Inc., a Standard Oil of California subsidiary, during 1979. By the end of 1980, Chevron, concessionaire of about a 280,000-square-kilometer area in the southern part of Sudan, had drilled 17 wells—3 were rated as discoveries, 1 had a small oil flow, 5 were successful confirmation holes, and 8 were dry. The first discovery was made in the spring of 1979, when well 1 Abu Gabra flowed 560 barrels per day at a depth of 9,000 feet. The second discovery, Unity wells, completed in the spring of 1980, about 175 kilometers southeast of the first discovery well, flowed 8,000 barrels per day from seven zones. The third discovery, completed early in the summer of 1980, about 60 kilometers northwest of Abu Gabra, was 1 Sharaf, which flowed 2,500 barrels per day from one zone at 9,000 feet. The fourth wildcat well which produced oil, but was not rated as a discovery, was well 1 Tabaldi, about 25 kilometers northwest of Abu Gabra. Four successful wells have been drilled in the Unity area, but Chevron was not certain by yearend whether they all tap the same reservoir. No

additional drilling had taken place near well 1 Sharaf discovery by end of 1980.

Concerning development priorities, Chevron would not indicate which reservoir was to be developed first, but confirmed that development programs were under discussion with Sudan's officials on production levels for export, as well as the production for refinery fuels.

A new exploration area was to be opened in the Sudd region, where Chevron was the sole concessionaire, operating under a production-sharing agreement with the Sudanese Government. By the end of 1980, Chevron's expenditure on oil exploration had reached over $160 million, and the sum of $70 million was budgeted for exploration in 1981.

Other companies active in exploration in Sudan were Texas Eastern, Union of Texas, and Total Exploration, a wholly State-owned subsidiary of France's Compagnie Francaise des Petroles (CFP-Total). A 10-year accord for the exploration of an area of 145,000 square kilometers in the south was signed in November 1980 by Sudan's Energy Minister and representatives of Total Exploration. Total Exploration was to hold a 65% interest, the Geneva-based International Energy Development Corp. was to hold 25%, and the State-owned Sudanese Public Petroleum Corp. was to hold the remaining 10%. Total Exploration was also due to begin drilling in a 6,400-square-kilometer area offshore Port Sudan as a part of a 3-year agreement with an optional 2-year extension. CFP-Total was to pay for all exploration and development as part of the offshore deal.

Refining.—The Ministry of Energy announced a project for construction of a new 10,000-barrel-per-day oil refinery to be built by Chevron over a 20-month period, scheduled to begin in early 1981. The refinery, capable of expansion to 25,000 barrels per day, was to be located at Kosti, 275 kilometers south of Khartoum, and was expected to go onstream in 1983 at an initial capacity of 15,000 barrels per day. The cost of the refinery with the pipeline, which will transport the crude from the Unity, Abu Gabra, and Sharaf oilfields and which is reportedly capable of producing between 11,000 and 15,000 barrels per day, was estimated at $200 million. The 500-kilometer, 10-inch pipeline will be capable of moving an initial 5,000 to 10,000 barrels per day. Funding for this project was discussed between Chevron, Sudan's Government, and the World Bank in 1980. The World Bank's soft loan affiliate, the International Development Association, has expressed its readiness to provide a loan for the project. The question of project equity was yet to be settled, but the Sudan Government had expressed a desire to have a share of between 60% and 70%.

Sudan's other refinery at Port Sudan on the Red Sea Coast, with a 2,600-barrel-per-day capacity, operated at full-rated capacity during 1980. This refinery, which processed Saudi Arabian crude in 1980, was owned by Shell-British Petroleum and the Sudan Government. The refinery supplied products to Khartoum through a 12,000-barrel-per-day pipeline, which was constructed and financed in 1977 by the Kuwait Metal Pipe Industries Co.

Consumption of Refinery Products.—Sudan consumed about 1.3 million tons of petroleum products in 1978, mostly produced in the Port Sudan refinery. In addition, Sudan imported 280,000 tons of product from the Kuwait National Petroleum Co.'s refinery. The following table shows product consumption in metric tons in Sudan for 1976 and forecasts by the Ministry of Energy for the years 1985 and 1990.

[1]Supervisory physical scientist, Branch of Foreign Data.

	1976	1985	1990
Liquefied petroleum gas	3,491	10,000	15,000
Aviation gasoline	5,609	3,000	3,000
Jet fuel	48,388	110,000	124,000
Gasoline	129,497	200,000	267,600
Kerosine	30,688	80,000	92,700
Gas oil	386,943	1,200,000	11,530,000
Diesel oil	24,462	50,000	60,000
Fuel oil	181,805	400,000	510,000
Asphalt	40,000	70,000	100,000
Lube oil and lubricants	34,366	40,000	60,000
Total	885,249	2,163,000	12,762,300

Source: Country report on "The Oil Situation in Sudan," presented in the First Arab Energy Conference, Abu Dhabi, United Arab Emirates, March 1979.

The Mineral Industry of Sweden

By Joseph B. Huvos[1]

In 1980, the mineral industry of Sweden remained small but technologically advanced. Sweden was potentially one of the world's largest iron ore producers and exporters and a significant producer of nonferrous metals and hydroelectric power. Fossil fuels and many important industrial minerals were imported.

In 1980, Sweden's gross national product was about $123 billion.[2] The consumer price index increased by 13.7%, and unemployment was, by yearend, 2%. The real growth rate of Sweden's economy decelerated to 2.2%. Among the industries that fared better-than-average were some of the important engineering sectors. Slow progress was made towards trimming and rationalizing the major industries that had been heavily subsidized, such as shipyards and the Svenskt Staal AB (SSAB). Forecasts for 1981 were even less favorable.

Indices of Swedish mineral industry production in 1979 and 1980 are shown in the following tabulation (1968=100):

Industry sector	1979[r]	1980[p]
Iron ore mining	80	90
Nonmetallic mineral products	89	89
Metal industries	114	107
Mining, quarrying, manufacturing	129	130

[r]Revised. [p]Preliminary.

Source: Monthly Digest of Swedish Statistics, No. 4, 1981, p. 13.

Significant events in Sweden's mineral industry in 1980 included startup of the apatite plant of Luossavaara Kiirunavaara AB (LKAB) in Kiruna, commissioning of three nuclear powerplants, and beginning of commercial oil production on Gotland Island. Construction continued to expand the Aitik copper mines and construction continued on three nuclear powerplants. Gränges AB allocated $100 million to modernize its aluminum industry. A contract was concluded by LKAB and Outokumpu Oy (Finland) to develop the Viscaria copper deposit. Significant silver and gold deposits were discovered by Boliden AB, and kaolin deposits, by Höganas AB. The decision was made by SSAB to cut back steel production and close some iron ore mines, and by Supra AB, to close an ammonia plant.

PRODUCTION

In 1980, iron ore mining gained; nonmetallics as a group were unchanged; metal industries declined; and industry as a whole gained little. Production of mineral commodities in 1980 and the 4 previous years is shown in table 1.

Table 1.—Sweden: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum, unalloyed:					
Primary	82,517	r82,597	82,019	81,955	97,200
Secondary	--	381	NA	NA	NA
Arsenic:					
White, refined	5,800	5,300	e5,400	e5,080	e4,080
Metallic	1,100	700	e700	NA	NA
Bismuth, mine output, metal content[e]	15	15	15	14	14
Copper:					
Mine output, metal content	44,860	44,764	47,611	45,773	42,769
Metal:					
Smelter:					
Primary	46,481	46,666	53,177	251,655	45,749
Secondary	15,565	15,008	13,830	12,889	10,692
Total	62,046	61,674	67,007	64,544	56,441
Refined:					
Primary	55,566	47,684	52,629	50,676	e46,713
Secondary	7,301	14,036	11,809	11,000	e9,000
Total	62,867	61,720	64,438	61,676	55,713
Gold:					
Mine output, metal content ---troy ounces	62,179	67,934	76,294	e70,000	e70,000
Metal including alloys ---------do	147,700	136,705	e140,000	149,629	e150,000
Iron and steel:					
Iron ore and concentrate, gross weight:					
Direct-shipping ore thousand tons	17,126	12,845	NA	15,696	NA
Concentrate do	12,736	11,994	NA	10,473	NA
Total do	29,862	24,839	21,486	26,169	27,184
Metal:					
Pig iron and sponge iron[3] do	3,139	2,490	2,481	3,033	2,436
Electric-furnace ferroalloys:					
Silicomanganese	7,461	--	--	--	--
Ferrosilicon	36,726	22,282	652	--	--
Silicon metal	17,968	12,687	8,753	e16,000	e16,000
Ferrochromium	116,486	134,452	166,238	189,299	e189,000
Ferrochromium-silicon	5,877	8,456	4,181	28,825	e20,000
Ferrotungsten	422	487	440	500	e500
Ferromolybdenum	1,830	1,003	1,131	1,365	e1,600
Ferrovanadium	575	423	616	500	e600
Total	187,345	179,790	182,011	236,489	227,700
Steel, crude thousand tons	5,140	3,968	4,325	4,628	4,236
Semimanufactures:					
Bars, rods, sections do	1,364	1,210	1,228	1,241	NA
Plates and sheets do	1,753	1,345	1,401	1,046	NA
Strip do	120	87	93	147	NA
Rails and accessories do	66	56	62	52	NA
Pipe and tube stock do	227	207	201	675	NA
Other including castings and forgings do	292	349	560		
Total do	3,822	3,254	3,545	3,161	NA
Lead:					
Mine output, metal content	81,625	88,132	81,900	81,626	72,200
Metal, refined:					
Primary	r21,814	r23,733	26,915	22,675	20,300
Secondary	r15,334	r17,420	18,143	18,962	22,000
Selenium, elemental, refined	r50	r80	56	68	68
Silver:					
Mine output, metal content thousand troy ounces	4,617	5,438	5,007	5,649	5,112
Metal including alloys do	6,363	6,810	7,692	9,473	e8,000
Tungsten, mine output, metal content	194	199	317	319	278
Uranium oxide (U_3O_8)[e]	70	80	80	NA	NA
Zinc:					
Mine output, metal content	128,326	140,233	162,800	169,854	167,400
Clinker (70%-75% Zn)	26,100	28,200	NA	NA	NA
NONMETALS					
Cement, hydraulic[4] thousand tons	2,869	r2,615	2,351	2,387	2,520
Chalk	37,529	36,205	32,096	35,822	NA

See footnotes at end of table.

Table 1.—Sweden: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Clays:					
Kaolin	--	298	344	327	e330
Refractory thousand tons	180	100	NA	NA	NA
Diatomite, calcined	327	--	--	--	--
Feldspar, salable, crude and ground	44,746	52,167	53,845	r e50,000	e50,000
Fluorspar	3,324	2,414	--	--	--
Gypsum, manufactured	142,800	211,100	NA	NA	NA
Lime: Quicklime, hydrated lime, dead-burned dolomite thousand tons	857	769	748	775	e800
Nitrogen, N content of ammonia do.	108	102	96	89	86
Phosphates: Thomas slag, gross weight do.	205	135	NA	NA	NA
Pigments, mineral, natural	1,009	975	NA	NA	NA
Pyrite and pyrrhotite (including cuprous), gross weight thousand tons	404	402	484	448	396
Sodium compounds:					
Sodium carbonate[e]	900	900	900	1,000	1,000
Sodium sulfate[e]	103,000	105,000	105,000	105,000	105,000
Stone, sand and gravel:					
Dimension stone:					
Unworked:					
Limestone and marble thousand tons	34	28	24	20	NA
Granite and gneiss do.	62	65	65	113	NA
Quartz do.	29	20	30	32	NA
Quartzite do.	23	3	NA	NA	NA
Micaceous schist do.	19	20	17	NA	NA
Sandstone do.	31	33	34	NA	NA
Other do.	26	15	17	NA	NA
Worked, all types[5] do.	86	68	NA	NA	NA
Crushed and broken stone:					
Clay slate do.	47	54	43	65	NA
Dolomite:					
Crude do.	370	360	372	354	NA
Burnt do.	40	25	21	NA	NA
Granite and gneiss do.	7,826	8,032	NA	NA	
Limestone:					
For cement manufacture do.	r2,378	r2,081	1,642	2,222	NA
For lime manufacture do.	881	752	812	NA	NA
For other industrial uses (including lime marl) do.	r3,298	r3,268	3,001	2,402	NA
Quartz do.	17	15	15	NA	NA
Quartzite do.	r1,744	r1,531	1,286	NA	NA
Sandstone do.	r296	r281	212	NA	NA
Other do.	906	1,036	975	NA	NA
Sulfur:					
S content of pyrite do.	205	204	233	282	249
Byproduct:					
From metallurgy[e] do.	140	135	130	130	130
From other sources do.	28	e30	18	36	e40
Total do.	e373	e369	381	448	419
Talc and steatite	r20,441	21,214	21,322	17,746	3,000
Other, crude[6]	5,873	3,104	NA	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	22,992	r23,523	25,497	NA	NA
Coal, all grades thousand tons	r9	r8	9	e9	e9
Coke, metallurgical do.	1,078	918	853	1,136	e1,000
Oil shale:					
For fuel production use do.	30	12	73	68	NA
For other use do.	11	6			
Peat:					
For agricultural use do.	89	92	95	e95	NA
For fuel use do.	32	30	30	--	--
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	20,893	21,083	21,048	20,944	23,146
Jet fuel do.	656	1,094	1,148	1,440	1,424
Kerosine do.	39	63	68	85	39
Distillate fuel oil do.	34,555	37,556	39,012	42,340	44,797
Residual fuel oil do.	38,908	39,846	43,293	48,335	51,535
Lubricants do.	210	142	214	e220	e220

See footnotes at end of table.

Table 1.—Sweden: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum refinery products —Continued					
Other:					
Naphtha thousand 42-gallon barrels	383	195	511	1,113	1,003
White spirit do	1,717	2,597	2,944	[e]3,000	[e]3,000
Unspecified do	5,320	NA	NA	NA	NA
Refinery fuel and losses do	6,795	6,771	6,925	[e]7,600	[e]8,100
Total do	109,476	109,347	115,163	125,077	133,264

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Oct. 5, 1981.

[2]In addition to the commodities listed, cobalt, nickel (as nickel sulfate), and metallic titanium are also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Production of sponge iron is as follows, in thousand tons: 1976—188; 1977—161; 1978—117; 1979—136; and 1980—not available.

[4]Includes clinker as follows, in thousand tons: 1976—111; 1977—43; 1978—15; 1979—not available; and 1980—not available.

[5]Represents material for sale, not that produced.

[6]Includes strontium minerals, unspecified minerals, and fragments of ceramic materials.

TRADE

Exports of goods in 1980 declined almost 3% in real terms, due mainly to the sluggishness of European markets, Sweden's principal trading partners. Imports rose 0.3% in real terms due to increased oil prices. The trade deficit was $2.7 billion. Sweden's total mineral trade in 1978 and 1979 is shown in tables 2 and 3.

Table 2.—Sweden: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	5,717	730	--	All to Norway.
Oxides and hydroxides	78	104	NA	Norway 42; Denmark 31.
Metal including alloys:				
Scrap	2,213	1,628	NA	West Germany 583; Finland 491; Denmark 178.
Unwrought	38,529	19,561	3,022	West Germany 5,536; Norway 4,449; Netherlands 3,055.
Semimanufactures	57,465	63,087	793	United Kingdom 10,470; Denmark 8,649; West Germany 5,019.
Chromium oxides and hydroxides	50	23	NA	Norway 11.
Copper:				
Ore and concentrate	15,794	27,173	--	Finland 19,628; East Germany 7,503.
Metal including alloys:				
Scrap	350	668	NA	West Germany 269; India 116; East Germany 92.
Unwrought	29,870	31,223	1,323	Belgium-Luxembourg 8,097; United Kingdom 6,781; France 5,304.
Semimanufactures	70,025	76,225	13,025	Norway 11,784; Denmark 11,350; West Germany 10,347.
Iron and steel:				
Ore and concentrate except roasted pyrite thousand tons	22,259	26,242	174	Belgium-Luxembourg 7,713; West Germany 7,129; France 2,761.
Roasted pyrite do	355	303	NA	United Kingdom 132; West Germany 95; Norway 46.
Metal:				
Scrap	78,784	17,366	455	West Germany 5,587; East Germany 3,383; Denmark 3,091.
Pig iron including cast iron	[r]510,538	150,319	7,523	Italy 45,759; Malaysia 30,074; Thailand 27,025.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Sponge iron, powder, shot	100,953	119,144	10,618	West Germany 16,361; United Kingdom 15,021; France 12,589.
Ferroalloys	168,079	145,842	11,027	West Germany 41,823; Italy 34,221; United Kingdom 22,359.
Steel, primary forms	r536,844	560,287	77,822	West Germany 115,021; Japan 102,605; United Kingdom 83,070.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r680,302	677,695	32,551	West Germany 121,908; United Kingdom 81,327; Finland 66,788.
Universals, plates, sheets	r545,412	655,966	49,175	West Germany 139,051; Norway 77,295; United Kingdom 76,702.
Hoop and strip	95,219	102,862	9,146	West Germany 15,987; Denmark 11,182; Finland 8,186.
Rails and accessories	44,074	30,315	--	Norway 20,137; West Germany 2,841; Singapore 2,794.
Wire	74,410	77,693	11,405	West Germany 9,741; Finland 6,701; France 6,583.
Tubes, pipes, fittings	r251,812	256,669	14,042	West Germany 37,578; Poland 27,838; United Kingdom 21,769.
Castings and forgings, rough	r2,700	2,543	NA	Denmark 1,234; Finland 641; Norway 337.
Lead:				
Ore and concentrate	58,385	59,190	--	West Germany 45,624; Belgium-Luxembourg 12,147.
Oxides	161	129	NA	NA.
Metal including alloys, all forms	54,746	45,441	NA	West Germany 21,621; Finland 7,369; Belgium-Luxembourg 6,493.
Magnesium metal including alloys:				
Scrap	494	239	101	West Germany 57; Netherlands 36; Denmark 24.
Unwrought and semimanufactures	14	8	NA	Denmark 3; Norway 2.
Manganese ore and concentrate	166	164	NA	Czechoslovakia 144.
Mercury 76-pound flasks	754	551	NA	United Kingdom 377; Denmark 87; West Germany 58.
Molybdenum ore and concentrate	921	1,129	40	West Germany 532; Netherlands 185; United Kingdom 128.
Nickel:				
Matte	798	64	--	All to Belgium-Luxembourg.
Metal including alloys:				
Scrap	498	482	7	India 201; United Kingdom 141; Finland 90.
Unwrought	1,720	1,516	NA	Mainly to Netherlands.
Semimanufactures	1,059	1,406	423	United Kingdom 171; West Germany 119; Italy 116.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$3,258	$6,955	$36	United Kingdom $5,728; Finland $411.
Silicon, elemental ---do---	$10,133	$15,300	NA	NA.
Silver:				
Waste and sweepings[1] ---do---	$12,300	$19,945	$1,380	United Kingdom $8,283; West Germany $7,988.
Metals including alloys, unwrought and partly wrought thousand troy ounces	7,909	7,298	NA	NA.
Tin metal including alloys:				
Scrap	16	8	--	All to Norway.
Unwrought and semimanufactures	r63	110	NA	Finland 42; Denmark 41.
Titanium:				
Ore and concentrate	--	388	NA	France 280.
Oxides	--	38	NA	United Kingdom 18.
Tungsten:				
Ore and concentrate	103	431	34	West Germany 236; Netherlands 92; United Kingdom 35.
Metal including alloys, all forms	49	54	NA	Ireland 27; United Kingdom 14.
Zinc:				
Ore and concentrate	294,355	347,574	3,050	Norway 88,588; West Germany 76,981; France 59,879.
Oxides	461	486	NA	Finland 180; Norway 108; West Germany 67.
Metal including alloys:				
Scrap	5,241	3,347	NA	Norway 2,113; West Germany 395; Belgium-Luxembourg 271.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Metal including alloys —Continued				
Unwrought and semimanufactures	235	324	NA	Norway 148; Finland 123.
Other:				
Ash and residue containing nonferrous metals	31,250	33,444	41	Norway 23,398; Italy 5,023; France 1,239.
Oxides, hydroxides, peroxides	r9	99	NA	West Germany 27; Netherlands 24; Italy 15.
Base metals including alloys, all forms	1,818	2,002	97	Finland 201; United Kingdom 181; West Germany 138.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	--	35	NA	United Kingdom 16.
Dust and powder of precious and semiprecious stones value, thousands	$53	$47	NA	Finland $39.
Grinding and polishing wheels and stones	2,284	2,447	4	West Germany 434; United Kingdom 334; Finland 319.
Asbestos, crude	--	112	NA	West Germany 102.
Boron materials: Oxide and acid	--	29	NA	NA.
Cement	18,253	165,394	NA	NA.
Chalk	9,556	9,309	NA	Norway 3,243; Denmark 2,035; Finland 1,583.
Clays and clay products:				
Crude	1,617	2,379	NA	West Germany 931; Norway 659; Denmark 263.
Products:				
Refractory including nonclay brick	32,444	36,742	147	Finland 14,129; Norway 7,741; Denmark 4,914.
Nonrefractory	32,391	28,252	134	Norway 10,140; Belgium-Luxembourg 3,740; Denmark 3,628.
Diamond:				
Gem, not set or strung value, thousands	$2,072	$3,363	NA	Finland $1,155; Norway $925; Switzerland $254.
Industrial do	$181	$38	NA	United Kingdom $21.
Diatomite and other infusorial earth	160	142	NA	Norway 32.
Feldspar, fluorspar, etc	38,370	35,537	98	United Kingdom 16,399; East Germany 9,242; Austria 2,545.
Fertilizer materials:				
Crude:				
Nitrogenous	--	2,310	--	All to Belgium-Luxembourg.
Phosphatic	65,045	43,816	--	All to Norway.
Other including mixed	300	1,520	NA	Norway 762; Denmark 750.
Manufactured:				
Nitrogenous[2]	6,210	14,471	NA	Denmark 6,000; Finland 2,198; Japan 1,757.
Phosphatic	42,749	6,205	NA	NA.
Potassic	3,371	440	--	All to Denmark.
Other including mixed	10,255	8,235	NA	Norway 5,735; Denmark 568; Finland 305.
Graphite, natural	28	47	41	NA.
Lime	1,091	2,292	NA	Norway 1,799; Sri Lanka 288.
Magnesite	138	551	NA	Denmark 495; Norway 43.
Mica, all forms	2	1	NA	Mainly to Norway.
Pigments, mineral: Processed iron oxides	29	45	NA	Finland 20.
Salt and brines	2,619	5,037	NA	Denmark 3,901; Norway 708.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	7,543	3,765	NA	NA.
Caustic potash, sodic and potassic peroxides	3,060	3,619	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	3,752	3,039	NA	Denmark 2,383; Netherlands 524.
Slate	15,524	19,568	NA	Belgium-Luxembourg 11,535; Norway 3,399; Denmark 2,686.
Other	135,265	200,455	35	Denmark 81,243; West Germany 69,023; Italy 23,448.
Worked	14,901	12,714	77	Denmark 9,100; Norway 1,277; West Germany 820.

See footnotes at end of table.

Table 2.—Sweden: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory-grade	2,088	4,347	NA	Denmark 1,432; Norway 995; West Germany 755.
Gravel and crushed rock thousand tons	1,574	1,574	NA	Denmark 825; West Germany 655; Norway 68.
Limestone except dimension do.	877	1,013	NA	Finland 703; West Germany 180; Denmark 127.
Quartz and quartzite	96,308	141,397	2,584	Norway 108,683; West Germany 12,952.
Sand excluding metal-bearing	66,291	67,624	NA	Norway 58,373; Denmark 5,247.
Sulfur:				
Elemental, all forms	17,332	20,597	--	Mainly to Netherlands.
Sulfuric acid, oleum	71,096	36,757	NA	Finland 30,605; Belgium-Luxembourg 3,681; Norway 2,236.
Talc, steatite, soapstone, pyrophyllite	4,528	3,776	NA	United Kingdom 2,214; West Germany 852; Netherlands 211.
Other:				
Crude	9,704	7,596	NA	Denmark 2,843; Norway 2,168; Finland 1,289.
Slag, dross, and similar waste, not metal-bearing	149,365	139,153	NA	United Kingdom 56,442; Finland 35,217; Norway 27,385.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	52	42	NA	Denmark 8.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	6,575	3,557	NA	Denmark 1,012; Norway 695; Hungary 663.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	76	NA	Norway 56.
Carbon black	8,099	6,296	NA	Norway 3,087; Finland 1,836; Denmark 837.
Coal, all grades including briquets	31,423	25,479	--	East Germany 8,193; West Germany 7,112; Denmark 6,828.
Coke and semicoke	95,725	26,502	NA	Finland 24,679; Norway 1,456.
Hydrogen, helium, rare gases	r84	171	NA	Norway 121; Denmark 28; Finland 19.
Peat including briquets and litter	29,070	33,141	NA	Denmark 18,150; Norway 10,442.
Petroleum refinery products:				
Crude thousand 42-gallon barrels	--	569	--	All to Finland.
Refinery products:				
Gasoline do.	3,326	3,893	NA	Denmark 2,598; Norway 1,153.
Kerosine and jet fuel do.	165	184	NA	Norway 146; Denmark 36.
Distillate fuel oil do.	4,485	4,602	NA	Denmark 2,725; Norway 1,421.
Residual fuel oil do.	10,280	12,360	NA	Denmark 4,629; United Kingdom 3,566; Belgium-Luxembourg 1,717.
Lubricants do.	r328	489	NA	Norway 171; Denmark 87; United Kingdom 74.
Mineral jelly and wax do.	2	3	NA	Mainly to Norway.
Other:				
Liquefied petroleum gas do.	r512	1,136	36	United Kingdom 915; Denmark 83; Norway 77.
Naphtha do.	1,219	1,374	NA	Netherlands 337; West Germany 330; Belgium-Luxembourg 282.
Pitch and pitch coke do.	(3)	2	NA	Mainly to Belgium-Luxembourg.
Petroleum coke, bitumen, other residues do.	r277	396	NA	Norway 218; Denmark 141.
Bituminous mixtures do.	35	35	NA	Finland 6; Netherlands 5; Norway 5.
Unspecified do.	33	74	NA	Mainly to Netherlands.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r160,224	207,372	NA	Netherlands 182,243; United Kingdom 14,730.

rRevised. NA Not available.
[1]May include platinum-group metals.
[2]Excludes quantities valued at $4,008,000 in 1978 and $5,123,000 in 1979.
[3]Less than 1/2 unit.

Table 3.—Sweden: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	58,167	67,791	523	Australia 26,805; Greece 15,652; France 11,881.
Oxides and hydroxides	185,191	199,589	1,410	Jamaica 67,800; Australia 61,967; West Germany 49,036.
Metal including alloys:				
Scrap	2,936	5,802	2,716	Norway 1,647; United Kingdom 680, Poland 512.
Unwrought	34,168	36,738	291	Norway 29,445; Denmark 1,509.
Semimanufactures	51,054	59,377	3,283	West Germany 15,765; Norway 7,811; France 4,928.
Chromium:				
Chromite	558,679	665,017	--	Finland 250,934; Albania 206,978; Turkey 63,353.
Oxides and hydroxides	522	500	NA	Mainly from West Germany.
Cobalt oxides and hydroxides	3	4	NA	Belgium-Luxembourg 2; Netherlands 1.
Copper:				
Ore and concentrate	34,323	33,153	NA	Norway 27,259; Ecuador 5,893.
Matte	11,616	10,371	NA	Mainly from France.
Metal including alloys:				
Scrap	4,075	6,232	461	France 4,114; Norway 760.
Unwrought	74,720	74,867	3,287	Zambia 15,926; Chile 13,696; Belgium-Luxembourg 10,072.
Semimanufactures	32,922	36,544	244	West Germany 9,251; United Kingdom 7,512; Poland 4,065.
Iron and steel:				
Ore and concentrate	121,000	33,000	NA	Mainly from Norway.
Metal:				
Scrap	117,642	129,756	10,792	Netherlands 33,516; U.S.S.R. 28,652; West Germany 13,730.
Pig iron including cast iron	40,489	49,837	NA	U.S.S.R. 15,569; Norway 10,529; West Germany 7,113.
Sponge iron, powder, shot	7,136	7,953	124	United Kingdom 2,516; Czechoslovakia 2,003; West Germany 1,786.
Ferroalloys	137,758	175,075	1,178	Norway 76,862; Republic of South Africa 26,158; France 22,323.
Steel, primary forms	r142,812	120,631	NA	Finland 59,794; West Germany 31,390; Denmark 12,057.
Semimanufactures:				
Bars, rods, angles, shapes, sections	r397,831	483,873	950	West Germany 110,865; United Kingdom 72,757; Norway 53,271.
Universals, plates, sheets	r873,277	946,010	5,989	West Germany 236,960; Belgium-Luxembourg 128,557.
Hoop and strip	r106,987	168,729	357	West Germany 54,311; Poland 33,945; United Kingdom 25,245.
Rails and accessories	2,681	3,947	--	West Germany 2,049; United Kingdom 874.
Wire	22,066	30,183	52	Belgium-Luxembourg 5,846; United Kingdom 5,299; France 4,912.
Tubes, pipes, fittings	r248,398	281,678	1,385	West Germany 69,032; United Kingdom 49,969; Finland 32,751.
Castings and forgings, rough	r8,221	10,041	NA	Poland 3,045; Norway 2,278; West Germany 1,628.
Lead:				
Oxides	1,930	1,742	9	West Germany 962; United Kingdom 473; East Germany 286.
Metal including alloys:				
Scrap	5,045	7,012	392	Canada 5,329; Norway 1,210.
Unwrought	1,691	2,954	NA	West Germany 785; Denmark 712; United Kingdom 506.
Semimanufactures	1,144	1,087	NA	West Germany 1,008; Netherlands 40.
Magnesium metal including alloys, all forms	1,796	1,773	116	Norway 1,442; Switzerland 61.
Manganese:				
Ore and concentrate	3,199	14,111	145	Republic of South Africa 10,912; Spain 2,753.
Oxides	429	616	162	Belgium-Luxembourg 267; Greece 132.
Mercury 76-pound flasks	725	696	NA	China, mainland 290; Spain 290.
Molybdenum:				
Ore and concentrate	6,484	7,902	3,279	Netherlands 2,625; Belgium-Luxembourg 582.
Metal including alloys	75	78	3	Austria 22; West Germany 22.
Nickel:				
Ore and concentrate	--	40	--	All from Japan.
Matte	5,329	3,447	--	Australia 2,556; U.S.S.R. 684.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Nickel —Continued				
Metal including alloys:				
Scrap	2,020	2,829	1,104	United Kingdom 844; West Germany 735.
Unwrought	8,326	11,620	2,394	United Kingdom 1,834; Canada 1,676; Australia 1,647.
Semimanufactures	1,144	1,290	228	United Kingdom 703; West Germany 136.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$20,039	$35,169	$6,143	United Kingdom $11,911; Switzerland $10,293.
Silver:				
Ore and concentrate[1] do.	$8,392	$2,671	--	France $1,416; Chile $711; Colombia $422.
Waste and sweepings[1] do.	$6,032	$16,308	$12,516	France $1,294; Finland $1,198; Denmark $680.
Metal including alloys, unwrought and partly wrought thousand troy ounces	15,368	15,786	3,086	United Kingdom 5,916; West Germany 3,440; France 2,315.
Tantalum metal including alloys, all forms value	$19,000	$106,000	$42,000	United Kingdom $56,000.
Tin metal including alloys:				
Unwrought including scrap	336	631	NA	West Germany 208; United Kingdom 155.
Semimanufactures	174	212	NA	United Kingdom 87; West Germany 82; Netherlands 39.
Titanium:				
Ore and concentrate	1,448	2,393	NA	Australia 1,930; India 440.
Oxides	4,530	5,539	9	Finland 2,368; Norway 1,980.
Tungsten:				
Ore and concentrate	2,420	2,161	--	China, mainland 665; Australia 625; Brazil 254.
Metal including alloys, all forms	44	28	3	West Germany 11; Japan 3; United Kingdom 3.
Zinc:				
Ore and concentrate	9,103	--	--	--
Oxides	1,488	1,206	NA	Netherlands 513; Norway 344; United Kingdom 192.
Metal including alloys:				
Scrap	--	71	NA	Finland 50.
Blue powder	458	527	NA	Mainly from Norway.
Unwrought	39,439	41,576	NA	Norway 18,459; Finland 14,886.
Semimanufactures	441	421	NA	West Germany 222; Poland 99; Belgium-Luxembourg 34.
Other:				
Ores and concentrates	999	1,129	NA	Republic of South Africa 810; Australia 280.
Ash and residue containing nonferrous metals	39,044	59,362	146	West Germany 20,843; Spain 8,526; Norway 7,666.
Oxides, hydroxides, peroxides	2,255	2,515	110	Finland 874; United Kingdom 516; West Germany 224.
Base metals including alloys, all forms	4,434	4,695	299	France 780; U.S.S.R. 743; Norway 394.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	1,055	1,839	9	Netherlands 777; Iceland 648; West Germany 224.
Dust and powder of precious and semiprecious stones value, thousands	$2,432	$2,603	$1,674	Switzerland $494; Republic of South Africa $230.
Grinding and polishing wheels and stones	2,345	3,097	214	Austria 965; United Kingdom 805; West Germany 399.
Asbestos, crude	1,334	861	NA	Mainly from Canada.
Barite and witherite	4,660	5,493	NA	West Germany 4,998; China, mainland 213; United Kingdom 146.
Boron materials:				
Crude natural borates	21,012	27,579	22,984	Turkey 4,595.
Oxide and acid	780	629	63	France 423; United Kingdom 65.
Cement	99,689	326,122	866	Finland 142,380; Poland 114,577; Denmark 62,718.
Chalk	26,541	30,227	7	United Kingdom 13,622; Denmark 8,016; West Germany 5,263.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products:				
Crude	298,802	336,841	26,071	United Kingdom 278,745; Czechoslovakia 15,551.
Products:				
Refractory including nonclay brick	97,086	105,170	931	West Germany 32,085; Austria 25,553; United Kingdom 18,883.
Nonrefractory	28,487	32,006	15	Italy 10,314; West Germany 7,264; Denmark 4,549.
Cryolite and chiolite	654	731	--	Denmark 616; Greenland 115.
Diamond:				
Gem, not set or strung value, thousands	$19,664	$14,138	$42	Belgium-Luxembourg $6,008; Israel $5,973.
Industrial do	$1,165	$1,366	NA	Republic of South Africa $691; United Kingdom $444.
Diatomite and other infusorial earth	4,111	5,562	1,203	Denmark 2,609; West Germany 524; Spain 523.
Feldspar, fluorspar, etc	20,817	15,858	NA	France 7,982; Canada 3,270; Mexico 2,067.
Fertilizer materials:				
Crude:				
Nitrogenous	9,354	8,304	NA	Mainly from Chile.
Phosphatic	574,411	619,160	122,579	Morocco 438,193; U.S.S.R. 55,428.
Manufactured:				
Nitrogenous	r486,193	482,885	15,559	Norway 440,558; Poland 15,645; Netherlands 10,362.
Phosphatic	2,636	1,646	NA	Israel 1,176; Republic of South Africa 424.
Potassic[2]	920	1,042	NA	Mainly from West Germany.
Other including mixed	91,604	214,974	562	Norway 151,614; Finland 38,466.
Ammonia	126,640	136,641	NA	Trinidad and Tobago 65,592; Mexico 53,247.
Graphite, natural	560	855	41	China, mainland 300; West Germany 215; Norway 143.
Gypsum and plasters	258,278	374,308	153	Spain 265,650; France 69,694; East Germany 22,525.
Lime	3,190	8,104	NA	Denmark 3,873; West Germany 2,737; Norway 1,319.
Magnesite	21,645	22,676	272	Norway 6,630; Greece 5,369; Spain 3,258.
Mica, all forms	433	543	1	Norway 207; United Kingdom 109.
Pigments, mineral: Processed iron oxides	7,890	7,868	38	West Germany 6,933; United Kingdom 341; Finland 168.
Precious and semiprecious stones except diamond kilograms	5,000	8,000	1,000	India 2,000; West Germany 1,000; Republic of South Africa 1,000.
Pyrite, gross weight	60,372	26,431	50	Mainly from Norway.
Salt and brines thousand tons	1,251	1,195	(3)	Netherlands 422; West Germany 263; Poland 158.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	66,179	151,753	NA	West Germany 80,037; Belgium-Luxembourg 35,860; East Germany 20,503.
Caustic potash, sodic and potassic peroxides	966	645	NA	West Germany 541; France 44; Belgium-Luxembourg 30.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	486	644	NA	Italy 330; Spain 76; Belgium-Luxembourg 67.
Slate	1,543	1,581	NA	Norway 1,442; Finland 93.
Other	3,347	4,789	NA	Finland 2,267; Norway 1,019; Portugal 647.
Worked:				
Slate	419	594	NA	Italy 234; Portugal 185.
Paving and flagstone	4,016	3,915	NA	Portugal 2,001; Poland 1,863.
Other	3,935	5,372	NA	Italy 2,417; Portugal 1,054; Finland 961.
Dolomite, chiefly refractory-grade	86,542	110,426	NA	United Kingdom 56,519; Norway 45,205.
Gravel and crushed rock	92,280	103,728	2,506	Finland 52,288; Denmark 26,761.
Limestone except dimension	82,106	95,784	NA	United Kingdom 63,124; Denmark 25,464.
Quartz and quartzite	27,551	34,298	3,629	Spain 17,603; Greece 12,196.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Sand excluding metal-bearing	485,333	472,551	138	Denmark 264,863; Belgium-Luxembourg 169,456.
Sulfur:				
Elemental, all forms	58,287	48,364	NA	Mainly from Poland.
Sulfuric acid, oleum	5,595	63,201	NA	Poland 24,378; West Germany 17,610; Norway 13,084.
Talc, steatite, soapstone, pyrophyllite	18,795	45,745	101	Finland 32,411; Belgium-Luxembourg 2,650; Austria 1,679.
Other:				
Crude	79,979	80,959	232	Norway 45,803; West Germany 28,457.
Slag, dross, and similar waste, not metal-bearing	14,889	33,454	NA	Denmark 22,612; Netherlands 7,666; Finland 1,320.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	862	2,152	NA	United Kingdom 1,225; East Germany 756.
Bromine, iodine, fluorine	19	15	1	West Germany 7.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	9,348	11,686	NA	United Kingdom 2,951; West Germany 2,476; Norway 1,634.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	750	1,065	344	Hungary 351; Trinidad and Tobago 319.
Carbon black	8,017	9,320	462	West Germany 4,682; United Kingdom 2,103; Netherlands 1,180.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	1,543	2,109	755	U.S.S.R. 512; Canada 164; West Germany 163.
Lignite including briquets	6,099	2,946	--	East Germany 2,738; West Germany 208.
Coke and semicoke	422,333	621,866	2,057	West Germany 315,554; United Kingdom 165,127.
Hydrogen, helium, rare gases	2,915	3,696	8	Netherlands 2,525; West Germany 720; Finland 233.
Peat including briquets and litter	5,586	8,241	NA	U.S.S.R. 5,512; Finland 2,076; Denmark 651.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	115,283	117,736	--	Saudi Arabia 37,094; United Kingdom 30,776; Nigeria 10,707.
Refinery products:				
Motor gasoline do	12,958	14,194	NA	Denmark 4,512; Finland 3,399; Belgium-Luxembourg 3,353.
Aviation gasoline do	182	85	NA	Netherlands 49; United Kingdom 28; Italy 8.
Kerosine and jet fuel do	4,639	4,832	(3)	Belgium-Luxembourg 1,635; United Kingdom 1,265; Netherlands 1,171.
Distillate fuel oil do	32,834	37,439	--	Venezuela 7,553; United Kingdom 6,623; U.S.S.R. 6,081.
Residual fuel oil do	33,634	50,623	--	U.S.S.R. 15,011; United Kingdom 6,137; Netherlands 5,449.
Lubricants do	r2,334	2,115	279	Netherlands 452; United Kingdom 281; West Germany 250.
Mineral jelly and wax do	113	111	1	West Germany 62; Hungary 12; United Kingdom 12.
Other:				
Liquefied petroleum gas do	726	1,099	NA	United Kingdom 374; Norway 211; Belgium-Luxembourg 208.
Naphtha do	7,438	9,179	--	Saudi Arabia 2,525; United Kingdom 1,724; Netherlands 1,587.
Pitch and pitch coke do	111	133	NA	United Kingdom 88; West Germany 29.
Petroleum coke, bitumen, other residues do	r1,568	1,085	387	NA.
Bituminous mixtures do	17	19	6	United Kingdom 4; Denmark 3; West Germany 2.
Unspecified do	540	454	(3)	U.S.S.R. 215; Finland 163.

See footnotes at end of table.

Table 3.—Sweden: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r36,460	37,175	2,707	West Germany 11,568; Netherlands 6,802; Belgium-Luxembourg 5,920.

rRevised. NA Not available.
[1]May include platinum-group metals.
[2]Excludes quantities valued at $16,225 in 1978 and $13,806 in 1979.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—As in the previous year, production of aluminum ran near capacity. Gränges Aluminium, Sweden's only aluminum producer, with its 82,000-ton-per-year plant located at Kubikenborg near Sundsvall on the Baltic Sea, decided on an investment program that exceeded $100 million. One of the items under consideration was to increase the capacity of the Sundsvall smelter to 100,000 tons per year. Final decision was delayed until after the Swedish referendum on nuclear power, which would assure availability of sufficient electric power. There were also negotiations between Gränges and Aardal og Sunndal Verk of Norway for cooperation by the two companies in the field of production of aluminum.

Copper, Lead, and Zinc.—Expansion of Boliden's Aitik copper mine, located in north Sweden, from 8 to 11.3 million tons of ore per year was proceeding according to the original plans, and the higher rate of production was to be reached during 1981.

In 1980, Boliden announced its plans to buy all shares of Elektrokoppar AB, with plants located in Helsingborg on the Öresund. Elektrokoppar, the largest manufacturer of copper wire rod in Nordic countries, is currently owned by ASEA AB (75%) and LM Ericsson (25%). It produces, among other products, 60,000 tons of copper wire rod per year, with Boliden supplying one-third of the company's raw material requirements.

Starting with 1983, for a 10-year period, copper concentrates produced at LKAB's Viscaria Mine in northern Sweden are to be delivered to Outokumpu's Harjavalta smelter, located near Pori in Finland. The deal was valued at $250 million.

The agreement has helped to revitalize the faltering project and will create new employment in the Kiruna area, offsetting a decline in iron mining. For Outokumpu, the deal secures about 15% of the company's copper concentrate requirements. The Finnish company had been seeking to invest in mining projects abroad to secure feed for its smelter as local output declined. Viscaria ore reserves were valued at 30 million tons, bearing 1.1% copper. There was to be open pit and underground mining at 1 million tons per year, resulting in 50,000 tons per year of 25% copper concentrates.

Gold and Silver.—In 1980, Boliden's extended mineral prospecting in various areas of Sweden has resulted in discoveries of significant gold and silver deposits. In the Garpenberg District of central Sweden, a complex sulfide ore deposit was discovered with reserves of over 5 million tons, and possible reserves of up to 10 to 15 million tons of ore, assaying over 200 grams per ton of silver and containing various other nonferrous metals, making it the largest silver mine of Europe. Construction costs at the deposit, named Damsjö Mine, are estimated at about $30 million, and production is expected to start in 1984.

Boliden had well-advanced plans to open a gold mine at Enaasen in the municipality of Ljusdal, Gävleborg County. Here, an ore body of 1 to 2 million tons was discovered containing 3 to 4 grams per ton of gold. The deposit is in an opencast mine situated in old diggings. The mine is expected to begin production in 1982.

Another complex sulfide ore body was

discovered about 100 kilometers west of Skellefteaa in northern Sweden. The find was expected to yield between 5 and 6 grams of gold per ton.

Boliden Mineral AB, a Boliden subsidiary, discovered ore deposits containing gold, silver, and other metals at the central Swedish mine of Saxberget, believed previously to be worked out. Two grams per ton of gold and 20 grams per ton of silver were found in the ore.

Iron Ore.—Vigorous marketing efforts combined with cost-cutting schemes were the main features of an action plan adopted by LKAB, Sweden's Government-owned iron ore mining company. The company's aim was to produce at least 25 million tons of iron ore from its three northern mines, of which at least 20 million tons was to be sold in Western Europe, although the market for this phosphorus ore was particularly unfavorable. The principal cost-cutting target was the freight charged by the State railways for transporting ore from the mines to the Swedish and Norwegian loading ports, which LKAB wished to cut by at least 50%. A Government proposal to cut freight cost was expected in 1981. Rationalization underway was to be pursued by combining the entire iron ore operation under a single division. The Government granted about $70 million to LKAB to cover 1980 losses and about $150 million for expected losses in 1981.

An additional cutback was SSAB's Straassa iron ore mine in central Sweden, to be closed permanently. This mine was supplying the Spännarhytten blast furnace at Surahammar, west of Stockholm, which was also to close. Closure of some other SSAB mines in central Sweden was also under consideration, where mining was said to be much more costly than at the LKAB mines in the north of the country.

Iron and Steel.—SSAB, a half Government, half privately-owned steelmaker, announced a series of production cutbacks as a result of slumping home and export demand. Affected were a small blast furnace at Luleaa that was being closed temporarily, until demand improves, and the smaller of two blast furnaces at Oxelösund.

At Domnarvets, the output of the electric shop was to be restricted to a rate of 275,000 tons per year, rather than 420,000 tons per year as previously planned. SSAB was already in the process of reducing operating capacity from 4 to 3 million tons per year, and the new cuts will further lower it by 500,000 tons. On the export side, sales of semimanufactures were weak, with very little market for slabs. Part of the reason was the European Economic Community's (EEC) 15% cutbacks in imports of steel in 1981. The EEC was SSAB's major export market. The only SSAB division doing well was the plate operation at Oxelösund where orders were up and sales were 10% above expected levels.

In 1980, SSAB's losses increased, despite large state aid, mainly due to changes in world steel market conditions. In 1980, the company lost about $120 million and about $315 million since its establishment in 1978.

The Swedish bar producer, Hallstahammars AB, announced plans to stop steel production. The company is part of Sweden's small independent carbon steel sector. Since 1973, demand has fallen about 50%, while pressure from imports remained intense. Hallstahammars' works in central Sweden has a 107- to 10,000-ton-per-year open-hearth furnace, a 200,000-ton-per-year blooming mill, and a 75,000-ton-per-year finishing mill. Fagersta AB, a major world producer of high-speed steel, has approved an investment of $5 million to rebuild a wire rodmill at its Laangshyttan works near Falun, north of Stockholm. This move is to consolidate the company's world position.

NONMETALS

Ammonia.—Escalating feedstock costs and weak ammonia prices have prompted Supra AB, a subsidiary of Boliden AB, to decide to close its ammonia plant at Kvantorp, central Sweden. The plant, commissioned in 1952, was rated at 54,000 tons per year of nitrogen and supplied ammonia for processing into fertilizers at Supra's Köping and Lanskrona fertilizer plants. As a consequence, Supra is to rely more heavily on imported ammonia for processing into fertilizers. Requirements are scheduled to increase to 220,000 tons per year in 1982, following the commissioning of a new nitric acid unit at Köping. About three-quarters of these were estimated to have to be imported to supplement the output of the company's only remaining ammonia unit, located at Köping.

Apatite.—A major producer of iron ore, Government-owned LKAB, made its first delivery of apatite concentrate (35% P_2O_5 content) from its new production plant at Kiruna, Swedish Lappland. The apatite is recovered from the phosphorus-rich tailings of LKAB's iron ore activities at Kiruna.

LKAB began dephosphorising of its iron ore in response to increasing demand for ore with a low phosphorus content. After the initial delivery was made to Norsk Hydro in Norway, commercial production was to begin in September 1981 at a rate of 50,000 tons per year. In the fertilizer year of 1982-83, full-scale production is scheduled to reach 200,000 tons per year. In addition to production from Kiruna, LKAB is planning to produce apatite at its Malmberget Mine, also in northern Sweden. Apatite concentrate from this mine has a P_2O_5 content of 39%, and if the decision is taken to go ahead, production should begin in 1983; capacity is 200,000 tons per year.

Feldspar.—In 1979, Sweden produced 50,000 tons of feldspar. The country's only producer was AB Forshammars Bergverk. Main production of the company was from the Limberget quarry in Örebro, about 40 kilometers north of Köping. The pegmatite rock in Limberget is white in color, with proven reserves of 700,000 tons of pegmatite, and indicated reserves of up to 100 meters depth are 4 million tons.

Graphite.—In 1980, a bulk furnace and a new ring furnace were commissioned for the production of graphite by Härnösands Grafit AB at its Härnösand plant, 250 miles north of Stockholm on the Gulf of Bothnia. The company is owned by the SIGRI Group, a West German corporation, and produces graphite electrodes and graphite powder. A second graphite manufacturer in Sweden was Union Carbide Norden AB, wholly owned by the Union Carbide Corp. of the United States, producing graphite electrodes at Trollhättan, south of Lake Vänern.

Kaolin.—A large kaolin find that could sharply reduce Swedish imports was announced by Höganäs, which already mines about 30,000 tons of ceramic-grade kaolin at Axeltorp. The deposit underlies presently worked deposits; a 1-ton-per-day pilot plant is in operation on the deposit. It is planned to start up a 100,000-ton-per-year operation in 1984. Total expenditure on the project is expected to be about $20 million. At present, most kaolin imports come from the United Kingdom, which exported in 1980 about 240,000 tons to Sweden.

Lime.—Total lime produced in Sweden in 1980 was approximately 800,000 tons, of which about 425,000 tons was sold in the open market while the balance was produced for internal consumption, mostly by companies that use burnt lime in the production of steel. However, approximately 45% of the marketed production was sold to the steel industry in 1979: 25% for pulp and chemical production, 15% for the manufacture of building materials, and 15% for water treatment and other minor uses. It was expected that by 1982, the overall open market demand will be less than 300,000 tons per year. Cementa AB, Sweden's only cement producer, is also the largest producer of burnt lime for the open market, with a production of about 210,000 tons in 1980. Lime production was centered on two plants: Köping to the west of Stockholm in central Sweden and Limhamn near Malmö in southern Sweden. Sweden's other major producer of lime for the open market was Strabrücken AB, which operates two plants in the Province of Dalecarlia: Boda on the north of Öland Island, off the southeast coast of Sweden, and at Rättvik in central Sweden. One other significant producer and user of burnt lime is Ytong AB, with a plant at Hällabrottet in central Sweden.

Magnetite.—From March 1980 onwards, AB Forshammars Bergverk, which is part of the Forshammar Group of Göteborg, an LKAB subsidiary, is to handle the marketing of a magnetite concentrate produced at LKAB's Malmberget Mine. The dried concentrate has an iron content of 71.5%, corresponding to a 99% pure magnetite, and a silica content of less than 0.2%. The company can supply a wide range of different particle sizes to meet specific requirements for use in heavy media separation, as a chemical catalyst, as an iron oxide pigment, and for electronic components, battery and welding electrodes, and small electric motors.

Olivine.—Sweden's only olivine producer in 1980 was Handöls Täljtens AB, which had a small output near the town of Handöl in northern Sweden. In former years, the company produced about 10,000 to 20,000 tons per year of lump, crushed, or graded olivine, and a large proportion of its production went to the parent company, Höganäs, for the production of forsterite bricks and other olivine-based refractories. However, refractory use of olivine has decreased to 5,000 to 7,000 tons per year and olivine is now used largely for the manufacture of bricks for night storage heaters.

MINERAL FUELS

In 1980, over one-fifth of Sweden's energy was supplied by domestic hydroelectric power, fuel wood, and waste heat. The remainder was imported oil, coal, and enriched

nuclear fuel. A report prepared by the Swedish Government shows the country's energy supply, in billions of kilowatt-hours, in 1980, as follows:

Oil	300
Water power	60
Nuclear power	22
Woodbark, etc	36
Coal	16
Timber	7
Waste heat	2
Total	443

Coal.—Plans were made for the construction of two new coal-fired powerplants, one at Oxelösund on the eastern shore and the other at Karlshamn in the south. Completion is planned for the end of the decade at a total cost of $1.5 billion. The Oxelösund plant alone was to produce 7 billion kilowatt-hours per year, about 5% of Sweden's electric supply. In 1980, no coal was produced in Sweden, and all coal was imported.

Nuclear Power.—In 1980, Sweden had the following nuclear powerplants in operation:

	Capacity (megawatts)
Oskarshamn-1	460
Ringhals-2	860
Oskarshamn-2	590
Ringhals-1	792
Barsebeck-1	590
Barsebeck-2	590

After a referendum in favor of nuclear power, the following nuclear powerplants were commissioned in 1980:

	Capacity (megawatts)
Ringhals-3	900
Fosmark-1	900
Fosmark-2	900

Futhermore there were three nuclear powerplants under construction:

	Capacity (megawatts)
Ringhals-4	900
Fosmark-3	1,060
Oskarshamn-3	1,100

Based on the current legislative situation, no further nuclear powerplants were planned.

In 1980, total nuclear-generated electricity was 26,727 gigawatt hours or 27% of total Swedish electric power production.

Peat.—It was reported that a large deposit of peat was discovered by the district government near Kiruna in northern Sweden. No plans were released for the utilization of the deposit.

The municipality of Umeaa was planning to build a peat-fired powerplant, to use 1.5 million cubic meters of peat per year. It was expected that the peat would be imported from Finland.

Petroleum.—In 1980, a decision was made to start commercial production of oil on Gotland Island. Production was expected to be only 20,000 tons per year. Greater hopes were attached by the Svenska Petroleum AB's Oil Prospecting Inc., the operator, to finding oil in the Hanö Bay area of southern Sweden.

A 20-year agreement was signed between Norway and Sweden for the supply of at least 2 million tons of Norwegian oil to Sweden in exchange for electric power, both at prevailing market prices. The agreement provided also for an industrial cooperation fund of about $50 million to help finance joint projects.

In 1980, Swedish refining capacity remained about 21 million tons per year, as shown in table 4.

[1]Physical scientist, Branch of Foreign Data.
[2]Where necessary, values have been converted from Swedish kroner (SKr) to U.S. dollars at the rate of SKr4.22=US$1.00 for 1980.

Table 4.—Sweden: Petroleum refining industry

Company	Ownership	Location of principal facilities	Approximate throughput (million tons per year)
Scandinaviska Raffinaderi AB (Scanraff).	Government and Texaco Oil AB	Lysekil	8.5
BP Raffinaderi AB (Göteborg) AB	British Petroleum Co. Ltd	Göteborg	5.5
Koppartrans Olje AB	Shell Oil Co	do	5.0
AB Nynas-Petroleum	Rederi AB Nordstjernan	Nynashamn	1.5
Do	do	Göteborg	.3
Do	do	Malmö	.2

The Mineral Industry of Switzerland

By Roman V. Sondermayer[1]

As in the past, the operations of the mineral industry of Switzerland were modest by world standards during 1980. Cement, lime, gypsum, salt, and sand and gravel were produced from domestic raw materials. In addition, the industry processed imported crude oil, alumina, and raw materials for the steel industry. Imported fuels were essential for an adequate supply of energy; hydropower and fuelwood supplied only about 16% of domestic energy consumption.

In general, the economy of Switzerland had a relatively good year. The country enjoyed a high level of employment, and private investment and foreign markets were the mainstays of the business cycle.

In the second half of 1980, signs of weakening began to show. Incoming orders started to decline, investment activity diminished, and the volume of imports and exports receded after the third quarter.

The real gross national product (GNP) rose about 2% in 1980 over that in 1979. Consumer prices rose on an average of 4%, which according to Swiss sources was still the lowest rate of inflation in the world.

The announcement of plans to modernize two aluminum plants and to build a new combination bar and rod mill were the principal events of the mineral industry during 1980.

PRODUCTION

In Switzerland, the mineral industry was privately owned, with no Government involvement. Table 1 shows the latest trends in production of minerals during the 1976-80 time period.

Table 1.—Switzerland: Production of mineral commodities[1]

(Thousand metric tons unless otherwise specified)

Commodity[2] and unit of measure	1976	1977	1978	1979	1980[p]
METALS					
Aluminum metal, smelter, primary ____tons__	78,172	79,751	79,468	82,974	86,302
Iron and steel metal:					
Pig iron and blast furnace ferroalloys ____	23	27	35	30	29
Electric furnace ferroalloys[e] ____	5	5	6	5	5
Crude steel ____	545	[r]654	784	886	900
Semimanufactures ____	547	635	679	[r e]720	750
NONMETALS					
Cement, hydraulic ____	3,546	3,649	3,697	3,934	4,252
Gypsum[e] ____	70	70	70	70	80
Lime ____	71	66	68	70	75
Nitrogen: N content of ammonia[e] ____	45	45	45	45	45
Salt ____	312	366	391	390	368
Sodium compounds: Sodium carbonate[e] ____tons__	45,000	45,000	45,000	45,000	45,000
Sulfur, byproduct, all sources[e] ____do____	2,000	2,000	3,000	3,000	3,262

See footnotes at end of table.

Table 1.—Switzerland: Production of mineral commodities[1] —Continued

(Thousand metric tons unless otherwise specified)

Commodity[2] and unit of measure	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS					
Gas, manufactured ——— million cubic feet	2,984	2,303	1,808	[e]1,800	[e]1,900
Petroleum refinery products:					
Gasoline ——— thousand 42-gallon barrels	8,415	8,475	7,434	8,381	9,520
Jet fuel ——— do	1,376	1,512	1,604	1,664	11,737
Kerosine ——— do	39	39	--	39	46
Distillate fuel oil ——— do	15,957	14,278	13,457	14,696	15,524
Residual fuel oil ——— do	7,333	6,747	5,354	6,380	4,431
Other ——— do	2,186	2,103	2,265	1,203	746
Refinery fuel and losses ——— do	1,469	1,318	1,200		1,379
Total ——— do	36,775	34,472	31,314	32,363	43,383

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 10, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (common clay, sand and gravel, and stone) is undoubtedly produced, but output is not reported and available general information is inadequate to make reliable estimates of output levels.

TRADE

Latest trends in Switzerland's foreign mineral trade are shown in tables 2 and 3. As the tables show, Switzerland had a brisk minerals trade, but many transactions were for reexport.

Table 2.—Switzerland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate kilograms	--	530	--	West Germany 500.
Oxide and hydroxide	163	1,189	1	West Germany 1,058; Italy 42.
Metal including alloys:				
Unwrought	32,876	47,376	234	Italy 20,918; West Germany 20,348; France 2,839.
Semimanufactures	66,038	76,395	521	West Germany 15,309; France 10,295; United Kingdom 6,846.
Antimony metal including alloys, all forms kilograms	1,312	375	NA	NA.
Beryllium metal including alloys, all forms do	15	56	--	West Germany 52; France 4.
Chromium oxide and hydroxide	79	22	(1)	NA.
Cobalt oxide and hydroxide kilograms	10,521	1,531	NA	Yugoslavia 1,450.
Columbium and tantalum: Tantalum metal including alloys, all forms do	215	1,023	179	West Germany 488; Yugoslavia 151.
Copper:				
Copper sulfate	106	47	NA	France 23; Austria 12.
Metal including alloys:				
Scrap	4,972	12,119	NA	West Germany 4,916; Austria 2,088; Belgium-Luxembourg 1,924.
Unwrought	[r]5,366	9,837	6	West Germany 6,067; Italy 2,802; United Kingdom 384.
Semimanufactures	16,529	19,379	1,771	West Germany 3,928; Italy 2,897; United Kingdom 2,753.
Gold metal, unworked or partly worked troy ounces	186,796	226,309	257	Iran 88,479; West Germany 43,500; Portugal 38,677.
Iron and steel:				
Ore and concentrate, including roasted pyrite	41	54	--	Peru 33; West Germany 4.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	88,080	100,690	9	Italy 82,730; West Germany 12,370; France 3,647.
Pig iron, ferroalloys, similar materials	2,380	1,210	(1)	West Germany 731; Poland 100; Turkey 71.
Steel, primary forms	22,394	21,399	--	West Germany 11,424; Italy 9,278.
Semimanufactures:				
Bars, rods, angles, shapes, sections	236,721	293,001	33	West Germany 220,860; France 23,081; Austria 21,447.
Universals, plates, sheets	22,752	37,959	18	West Germany 28,543; Austria 4,519.
Hoop and strip	18,122	25,515	(1)	West Germany 11,020; Austria 9,774; France 4,281.
Rails and accessories	r2,834	1,647	2	Austria 702; West Germany 597; Greece 194.
Wire	5,060	6,062	53	West Germany 1,773; France 1,519; Austria 941.
Tubes, pipes, fittings	128,348	161,988	598	West Germany 52,653; U.S.S.R. 20,401; Netherlands 13,118.
Castings and forgings, rough	9,389	12,714	38	West Germany 4,494; France 3,986; Italy 1,369.
Ingots and semimanufactures of alloy steel and high-carbon steel	34,404	46,066	541	West Germany 17,891; Italy 15,116; France 8,276.
Lead:				
Oxide	23	57	NA	Austria 51; Italy 3.
Metal including alloys:				
Scrap	8,530	11,608	--	Italy 6,879; Austria 2,048; West Germany 1,159.
Unwrought	2,796	4,874	NA	Italy 2,054; West Germany 1,200; Netherlands 914.
Semimanufactures	88	55	NA	Italy 21; Belgium-Luxembourg 20; France 10.
Magnesium metal including alloys, all forms	313	440	(1)	West Germany 165; United Kingdom 75; Sweden 63.
Manganese oxides	44	9	(1)	Mainly to Sweden.
Mercury ---- 76-pound flasks	59	174	(1)	West Germany 108; Iraq 38.
Molybdenum metal including alloys, all forms	5	2	(1)	West Germany 1.
Nickel:				
Matte, speiss, similar materials	66	384	--	West Germany 268; Netherlands 103; Algeria 12.
Metal including alloys:				
Scrap	179	295	(1)	West Germany 280; United Kingdom 15.
Unwrought and semimanufactures	369	376	4	West Germany 131; France 37; Italy 28.
Platinum-group metals including alloys, all forms ---- thousand troy ounces	1,016	760	8	Japan 211; France 176; Belgium-Luxembourg 64.
Silver metal including alloys, all forms ---- do	38,994	33,472	23	Italy 13,812; West Germany 9,035; France 4,436.
Tin metal including alloys:				
Scrap	68	90	--	West Germany 57; France 24; Netherlands 9.
Unwrought	84	168	--	Denmark 72; Italy 45; France 19; West Germany 19.
Semimanufactures	34	36	NA	Austria 12; Italy 8; West Germany 5.
Titanium oxides	111	210	NA	Austria 56; Ivory Coast 56; West Germany 52.
Tungsten metal including alloys, all forms	23	24	(1)	France 10; West Germany 6; United Kingdom 5.
Uranium and thorium oxides, including rare-earth oxides ---- kilograms	1,922	1,334	61	West Germany 155; France 80; Yugoslavia 56.
Zinc:				
Oxide	51	45	NA	West Germany 27; Ivory Coast 15.
Metal including alloys:				
Scrap	r757	1,242	NA	Italy 832; West Germany 208; France 144.
Blue powder	11	14	NA	Austria 10.
Unwrought	207	151	NA	Austria 104; Italy 40; West Germany 5.
Semimanufactures	9	15	NA	Morocco 5; Austria 3; Italy 1; West Germany 1.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates, n.e.s	91	592	--	Turkey 233; Austria 221; Portugal 75.
Ash and residue containing nonferrous metals	23,457	25,811	--	West Germany 15,675; Italy 3,347; Belgium-Luxembourg 3,125.
Waste and sweepings of precious metals	192	268	(1)	France 133; West Germany 86; Austria 15.
Oxides, hydroxides, peroxides of metals, n.e.s	302	403	52	West Germany 206; Italy 88; United Kingdom 14.
Metals including alloys, all forms:				
Metalloids	4,532	6,459	(1)	West Germany 5,264; Japan 302; Austria 222.
Alkali, alkaline earth, rare-earth metals, kilograms	515	15,568	7	NA.
Base metals including alloys, all forms, n.e.s	119	167	30	West Germany 65; United Kingdom 39; Netherlands 7.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, natural corundum, etc	49	29	(1)	Sweden 24.
Dust and powder of precious and semi-precious stones, kilograms	1,724	1,970	95	Italy 646; France 356; Belgium-Luxembourg 225.
Grinding and polishing wheels and stones	878	1,058	7	United Kingdom 307; West Germany 163; Algeria 115.
Asbestos	37	142	(1)	Cyprus 36; Italy 31; France 21; Austria 19.
Barite and witherite	34	10	NA	West Germany 4.
Boron materials:				
Crude natural borates, kilograms	102	1,032	--	NA.
Oxide and acid	80	5	(1)	NA.
Cement	31,519	28,340	NA	West Germany 24,188; France 4,054.
Chalk	2,029	2,282	NA	France 2,149; West Germany 64; Austria 30.
Clays and clay products (including all refractory brick):				
Crude	20,948	9,435	--	West Germany 8,699; France 497; Austria 104.
Products:				
Refractory (including nonclay brick)	1,546	1,563	1	West Germany 816; Egypt 254; Austria 223.
Nonrefractory	47,146	46,802	3	West Germany 15,433; Austria 11,720; Italy 9,354.
Cryolite and chiolite	4	1	NA	NA.
Diamond:				
Gem, not set or strung, value, thousands	$1,015,596	$1,234,023	$54,191	Israel $451,580; United Kingdom $390,280; Belgium-Luxembourg $134,046.
Industrial, do	$28,554	$32,058	$534	Italy $10,800; France $5,363; Belgium-Luxembourg $3,988.
Diatomite and other infusorial earth	51	6	(1)	France 1.
Feldspar and fluorspar	397	255	NA	West Germany 78; Peru 62; Portugal 32.
Fertilizer materials:				
Crude:				
Nitrogenous, kilograms	4,150	600	--	NA.
Phosphatic, do	5	20	--	NA.
Potassic	37	2	NA	France 1.
Manufactured:				
Nitrogenous	r273	706	NA	West Germany 431; Austria 72; Italy 64.
Phosphatic	4	4	NA	Mainly to United Arab Emirates.
Potassic	37	2	NA	France 1.
Other including mixed	1,018	1,709	(1)	France 377; West Germany 333; Ecuador 319.
Ammonia	64	7	NA	France 2; West Germany 1.
Graphite, natural	11	11	4	West Germany 1.
Gypsum and plasters	627	667	(1)	Austria 298; Greece 208; Italy 77.
Lime	2,312	1,944	NA	West Germany 731; France 634; Iraq 523.
Magnesite	63	32	NA	West Germany 7; France 4; Austria 2.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Mica:				
Crude including splittings and waste	73	46	NA	West Germany 25; Sweden 5.
Worked including agglomerated splittings	568	508	3	India 83; United Kingdom 60; Sweden 57.
Pigments, mineral:				
Natural, crude	31	18	NA	Austria 3.
Iron oxides, processed	48	50	(1)	West Germany 18; Iraq 7; Yugoslavia 7; United Kingdom 6.
Precious and semiprecious stones except diamond:				
Natural value, thousands	$165,603	$206,272	$12,574	France $37,248; West Germany $28,268; United Kingdom $27,809.
Manufactured thousand carats	216,655	262,930	4,705	West Germany 65,040; Austria 47,165; U.S.S.R. 44,100.
Salt and brines	377	3,459	NA	Austria 3,050; France 340; West Germany 18.
Sodium and potassium compounds, n.e.s	30,299	47,182	NA	West Germany 24,229; Austria 15,255; Belgium-Luxembourg 4,841.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	34,328	33,299	--	West Germany 23,429; Italy 7,140; France 1,357.
Worked	11,734	14,553	(1)	West Germany 12,041; Austria 2,108.
Dolomite, chiefly refractory grade	68	8	NA	Austria 4; West Germany 3.
Gravel and crushed rock	14,997	9,728	NA	West Germany 5,516; France 3,175.
Limestone except dimension	15	--		
Quartz and quartzite	34,139	34,441	--	Italy 31,798; West Germany 2,207.
Sand excluding metal-bearing	7,851	6,790	(1)	France 3,694; West Germany 1,518; Italy 1,199.
Sulfur:				
Elemental:				
Other than colloidal	13	15	--	NA.
Colloidal	10	5	NA	West Germany 3; United Kingdom 1.
Sulfuric acid	14,828	26,801	NA	West Germany 15,189; Czechoslovakia 6,975.
Talc, steatite, soapstone, pyrophyllite	71	71	NA	Austria 25; France 12; West Germany 3.
Other:				
Crude:				
Meerschaum, amber, jet kilograms	15	--		
Other	3,275	2,665	(1)	West Germany 1,167; Austria 735; France 584.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	23,050	15,128	NA	West Germany 14,883.
Slag and ash, n.e.s	550	795	--	France 764; Italy 31.
Oxides and hydroxides of magnesium, strontium, barium	20	22	(1)	Spain 5; West Germany 4; Colombia 2; Italy 1.
Bromine, iodine, fluorine	62	21	(1)	West Germany 10; Romania 5; France 2; Algeria 1.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	4,902	6,157	NA	France 1,724; West Germany 1,432; Italy 1,037.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	60	2	--	NA.
Carbon black	253	192	(1)	France 59; Czechoslovakia 55; U.S.S.R. 26.
Coal, all grades, including briquets	341	5,225	(1)	East Germany 4,260; Austria 526; Italy 349.
Coke and semicoke	47	938	--	Austria 870; West Germany 68.
Gas, hydrocarbon, manufactured	77	58	--	Mainly to France.
Hydrogen, helium, rare gases	128	53	2	Austria 19; United Kingdom 19; Iraq 6.
Peat, including peat briquets and litter	1,937	2,215	--	France 1,330; Austria 672; Saudi Arabia 117; West Germany 96.
Petroleum:				
Crude—42-gallon barrels	89	3	NA	NA.

See footnotes at end of table.

Table 2.—Switzerland: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products:				
Gasoline, including natural thousand 42-gallon barrels	51	31	(1)	Mainly to Austria.
Distillate fuel oil ——do——	17	25	(1)	Austria 10; Italy 5; Saudi Arabia 2; West Germany 1.
Residual fuel oil ——do——	150	105	--	Austria 95; France 10.
Lubricants ——do——	r25	28	(1)	West Germany 12; Austria 3; Italy 3; France 2.
Other:				
Liquefied petroleum gas ——do——	263	195	NA	Italy 74; West Germany 70; Austria 50.
Mineral jelly and wax ——do——	12	4	(1)	Italy 3.
Pitch and pitch coke ——do——	(1)	(1)	(1)	
Petroleum coke ——do——	(1)	1	(1)	Mainly to West Germany.
Bitumen and other residues and bituminous mixtures, n.e.s ——do——	41	15	(1)	West Germany 12; Finland 1.
White spirit ——do——	(1)	1	(1)	Mainly to Austria.
Total ——do——	r559	405		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,419	1,169	(1)	West Germany 689; Italy 154; Sweden 59; Iraq 57.

rRevised. NA Not available.
1Less than 1/2 unit.

Table 3.—Switzerland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	7,693	6,995	--	West Germany 3,413; France 1,573; Australia 1,235.
Oxide and hydroxide	152,844	151,287	169	Australia 118,574; Italy 13,420; Surinam 9,311.
Metal including alloys:				
Unwrought including scrap	35,314	41,184	19	Iceland 17,101; Norway 13,306; Egypt 4,252.
Semimanufactures	35,465	42,540	308	West Germany 18,368; France 4,790; Belgium-Luxembourg 4,421.
Antimony metal including alloys, all forms	126	28	--	China, mainland 27.
Beryllium metal including alloys, all forms kilograms	412	2,530	274	West Germany 2,213; France 14.
Chromium oxide and hydroxide	459	519	1	West Germany 384; Italy 40; France 31.
Cobalt oxide and hydroxide	16	2	--	Mainly from Belgium-Luxembourg.
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	r1,066	1,828	691	Austria 814; West Germany 201.
Copper:				
Ore and concentrate	28	20	--	All from Belgium-Luxembourg.
Copper sulfate	854	1,036	--	France 386; U.S.S.R. 296; Czechoslovakia 111.
Metal including alloys:				
Scrap	4,952	3,395	NA	West Germany 1,495; Austria 951; Israel 433.
Unwrought	r23,212	12,100	476	West Germany 4,531; Belgium-Luxembourg 2,877; Austria 1,287.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Copper —Continued				
Metal including alloys —Continued				
Semimanufactures	63,032	78,027	690	West Germany 35,849; United Kingdom 15,722; Italy 7,217.
Gold metal, unworked and partly worked troy ounces	41,603	78,158	3,376	Lebanon 21,830; West Germany 19,451; Kuwait 17,844.
Iron and steel:				
Ore and concentrate including roasted pyrite	59,552	58,723	1	Mauritania 36,767; West Germany 18,716; Italy 3,176.
Metal:				
Scrap	87,236	179,051	1,944	West Germany 149,232; Netherlands 12,804.
Pig iron and similar materials	83,591	98,118	6	West Germany 42,112; France 34,967; Canada 9,118.
Ferroalloys	18,772	24,295	56	France 5,584; Norway 5,502; West Germany 3,178.
Steel, primary forms	66,984	109,734	6	West Germany 29,765; Netherlands 16,700.
Semimanufactures:				
Bars, rods, angles, shapes, sections	410,706	467,475	29	West Germany 152,907; Italy 119,141; Belgium-Luxembourg 76,417.
Universals, plates, sheets	508,793	548,234	5,020	West Germany 142,856; France 116,811; Belgium-Luxembourg 67,544.
Hoop and strip	171,467	203,856	419	West Germany 66,151; Belgium-Luxembourg 63,751.
Rails and accessories	47,768	55,708	--	Austria 30,890; West Germany 15,327; Italy 6,354.
Wire	21,851	22,060	112	West Germany 7,992; Austria 6,355; Belgium-Luxembourg 2,528.
Tubes, pipes, fittings	140,270	155,189	129	West Germany 57,717; France 34,994; Italy 22,736.
Castings and forgings, rough	6,647	7,186	NA	West Germany 4,018; Romania 954; Austria 758.
Ingots and semimanufactures of alloy steel and high-carbon steel	164,719	166,936	776	West Germany 69,354; France 25,503; United Kingdom 16,089.
Lead:				
Ore and concentrate	--	5	--	Mainly from Morocco.
Oxides	174	102	NA	Mexico 72; United Kingdom 20; West Germany 5.
Metal including alloys:				
Scrap kilograms	70,875	1,305	--	France 880; West Germany 425.
Unwrought	15,048	11,592	NA	United Kingdom 4,991; France 3,114; West Germany 1,997.
Semimanufactures	1,469	1,407	1	West Germany 1,269; Belgium-Luxembourg 93; France 20.
Magnesium metal including alloys, all forms	1,673	2,190	86	Norway 1,297; Italy 486; Canada 265.
Manganese oxides	513	800	73	Greece 523; West Germany 145; Japan 35.
Mercury 76-pound flasks	702	731	41	West Germany 323; United Kingdom 133; China, mainland 100.
Molybdenum metal including alloys, all forms	17	13	3	Austria 6; West Germany 2; France 1.
Nickel:				
Matte, speiss, similar materials	1,460	1,579	42	Canada 291; Norway 235; Finland 180; U.S.S.R. 175.
Metal including alloys:				
Scrap	60	227	52	Netherlands 83; Italy 34; United Kingdom 25; France 18.
Semimanufactures	1,283	1,351	302	West Germany 496; United Kingdom 368; Sweden 73.
Platinum-group metals including alloys, all forms troy ounces	708,698	678,090	76,486	West Germany 148,279; France 132,590; U.S.S.R. 104,972.
Silver metal including alloys, all forms thousand troy ounces	36,933	26,099	46	United Kingdom 5,355; West Germany 2,683.
Tin:				
Ore and concentrate kilograms	--	50	--	NA.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tin —Continued				
Metal including alloys:				
Scrap	6	24	--	Italy 17.
Unwrought	932	868	5	Indonesia 290; Malaysia 271; Thailand 80.
Semimanufactures	249	178	1	West Germany 90; France 37; Netherlands 31.
Titanium oxide	7,194	6,141	NA	France 2,466; West Germany 1,020; United Kingdom 899.
Tungsten metal including alloys, all forms	r92	39	4	West Germany 17; France 10; Austria 3.
Uranium and thorium oxides including rare-earth oxides	15	14	1	France 9; Austria 2; United Kingdom 1; West Germany 1.
Zinc:				
Ore and concentrate	8	5	--	NA.
Oxide	r2,534	2,632	12	France 1,293; West Germany 690; United Kingdom 369.
Metal including alloys:				
Scrap, kilograms	59,250	110	--	All from West Germany.
Blue powder	2,160	2,171	NA	Belgium-Luxembourg 1,132; Netherlands 425; France 346.
Unwrought	25,855	21,605	--	West Germany 8,993; Netherlands 2,360; France 2,157.
Semimanufactures	1,193	1,103	1	West Germany 468; Belgium-Luxembourg 372; Italy 88.
Other:				
Ores and concentrates	6,089	7,237	5	Republic of South Africa 3,648; Australia 2,056; West Germany 839.
Ash and residue containing nonferrous metals	164	198	--	Austria 97; West Germany 67; Belgium-Luxembourg 34.
Waste and sweepings of precious metals	63	144	1	Italy 47; West Germany 30; Saudi Arabia 17; France 16.
Oxides, hydroxides, peroxides of metals, n.e.s	1,358	1,585	55	West Germany 1,053; Belgium-Luxembourg 184; France 91.
Metals including alloys, all forms:				
Metalloids	3,855	3,474	40	France 1,204; Italy 976; U.S.S.R. 433.
Alkali, alkaline earth, rare-earth metals	502	521	34	West Germany 476; France 4; United Kingdom 4.
Base metals including alloys, all forms, n.e.s	917	803	117	Republic of South Africa 133; France 121; West Germany 103.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, natural corundum, etc	1,080	1,140	139	West Germany 593; Italy 383.
Dust and powder of precious and semi-precious stones, kilograms	2,401	3,069	517	Ireland 2,137; United Kingdom 277; West Germany 66.
Grinding and polishing wheels and stones	2,017	1,774	45	West Germany 883; Austria 223; Italy 202.
Asbestos	22,794	20,689	19	Canada 8,105; Republic of South Africa 5,923; U.S.S.R. 4,421.
Barite and witherite	2,880	2,291	NA	West Germany 1,879; France 350; Italy 60.
Boron materials:				
Crude natural borates	7,297	10,340	10,144	Netherlands 123; Turkey 70.
Oxide and acid	594	509	160	France 254; U.S.S.R. 40; West Germany 26; Turkey 25.
Cement	146,174	173,124	34	Italy 90,897; West Germany 36,708; France 34,188.
Chalk	25,192	22,143	NA	France 19,011; West Germany 1,697; Italy 1,181.
Clays and clay products (including all refractory brick):				
Crude	178,261	185,428	1,326	West Germany 68,289; United Kingdom 64,218; France 24,126.
Products:				
Refractory (including nonclay brick)	33,638	40,807	104	West Germany 18,122; Austria 7,861; France 3,726.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products (including all refractory brick) —Continued				
Products —Continued				
Nonrefractory	227,159	274,066	18	Italy 165,949; West Germany 68,571; France 26,673.
Cryolite and chiolite	845	349	--	Denmark 340; West Germany 9.
Diamond:				
Gem, not set or strung value, thousands	$1,141,973	$1,396,979	$72,925	United Kingdom $980,039; Belgium-Luxembourg $148,768; U.S.S.R. $33,845.
Industrial do	$26,609	$33,863	$3,841	Ireland $22,135; Belgium-Luxembourg $2,640; United Kingdom $2,121.
Diatomite and other infusorial earth	8,098	9,102	129	Denmark 6,162; Spain 1,103; France 1,022.
Feldspar and fluorspar	10,065	8,605	--	Italy 3,952; West Germany 2,671; France 1,106.
Fertilizer materials:				
Crude:				
Nitrogenous	109	35	NA	NA.
Phosphatic	11,393	13,020	--	Morocco 10,832; Togo 1,547; Netherlands 460.
Manufactured:				
Nitrogenous	72,179	91,791	NA	Austria 39,837; West Germany 32,489; France 8,897.
Phosphatic:				
Thomas (basic) slag	146,786	140,075	--	France 93,349; Belgium-Luxembourg 46,683.
Other	8,940	13,258	4,706	France 2,973; Belgium-Luxembourg 2,628; Netherlands 1,736.
Potassic	r84,004	87,606	--	France 73,341; West Germany 9,148; East Germany 5,116.
Other including mixed	99,036	133,797	13,718	France 56,451; West Germany 30,576; Austria 15,161.
Ammonia	20,266	22,836	--	Austria 16,240; France 5,831; West Germany 593.
Graphite, natural	190	202	35	West Germany 85; Austria 45; United Kingdom 2.
Gypsum and plasters	52,454	63,138	18	West Germany 41,756; Italy 10,822; France 10,343.
Lime	39,508	46,166	--	Italy 28,175; West Germany 17,836.
Magnesite	4,310	4,369	10	Austria 3,226; Spain 513.
Mica:				
Crude including splittings and waste	638	598	NA	India 354; France 66; West Germany 63.
Worked including agglomerated splittings	654	496	1	France 313; Belgium-Luxembourg 122; Austria 27.
Pigments, mineral:				
Natural, crude	359	319	--	Austria 139; West Germany 119; France 42.
Iron oxides, processed	2,780	2,896	5	West Germany 2,778; United Kingdom 71; France 24.
Precious and semiprecious stones, except diamond:				
Natural value, thousands	$184,929	$263,208	$15,443	Panama[1] $40,993; West Germany $30,727; United Kingdom $30,107.
Manufactured thousand carats	76,655	99,660	1,335	France 91,485; West Germany 2,860; Austria 1,015.
Pyrite, gross weight	164	16,020	--	U.S.S.R. 15,906; Italy 104; West Germany 10.
Salt and brines	1,840	1,966	NA	France 1,488; West Germany 334.
Sodium and potassium compounds, n.e.s	15,265	16,676	NA	Italy 6,125; France 5,475; West Germany 4,118.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	141,653	128,364	NA	West Germany 65,212; Austria 32,460; Italy 17,843.
Worked	73,234	92,605	(2)	Italy 70,388; Austria 8,636; West Germany 5,180.
Dolomite, chiefly refractory grade	21,924	28,404	--	Italy 21,367; France 6,351.
Gravel and crushed rock thousand tons	4,261	4,823	--	France 2,411; West Germany 1,374; Italy 745.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Limestone except dimension	6,714	19,893	NA	Italy 12,950; France 6,665; West Germany 278.
Quartz and quartzite	18,605	26,435	205	Italy 15,487; West Germany 7,115; Norway 2,803.
Sand excluding metal-bearing thousand tons	1,154	1,226	(2)	Italy 542; France 321; West Germany 234.
Sulfur:				
Elemental:				
Colloidal	213	158	--	France 124; West Germany 34.
Other than colloidal	46,656	46,560	--	West Germany 45,808; France 722.
Sulfuric acid including oleum	2,538	2,581	--	West Germany 1,969; Italy 385; Austria 181.
Talc, steatite, soapstone, pyrophyllite	10,766	10,910	NA	Austria 6,872; France 1,398; Italy 1,351.
Other:				
Crude:				
Meerschaum, amber, jet kilograms	18,135	4	NA	NA.
Other	76,742	80,650	765	West Germany 38,262; France 16,583; Italy 8,541.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	4,717	5,284	--	West Germany 3,094; France 2,189.
Slag and ash, n.e.s	18,807	18,805	--	West Germany 11,403; France 6,833; Italy 545.
Oxides and hydroxides of magnesium, strontium, barium	290	259	1	France 123; West Germany 73; East Germany 20.
Bromine, iodine, fluorine	3,284	3,578	439	France 1,487; Israel 1,256; East Germany 278.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	19,805	26,678	NA	West Germany 13,181; Austria 6,672; France 3,563.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,731	1,266	125	Trinidad and Tobago 1,131.
Carbon black and gas carbon:				
Carbon black	4,479	3,982	139	West Germany 2,549; France 458; Netherlands 430.
Gas carbon	75	164	--	West Germany 93; Italy 71.
Coal, all grades, including briquets	190,679	378,668	6,086	West Germany 171,646; Republic of South Africa 165,356.
Coke and semicoke	r121,453	137,706	50	West Germany 98,088; France 29,651.
Gas, hydrocarbon, manufactured kilograms	65	230	NA	NA.
Hydrogen, helium, rare gases	r3,284	3,617	17	West Germany 2,937; Italy 584.
Peat including peat briquets and litter	77,734	74,313	NA	West Germany 51,580; U.S.S.R. 21,827.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	r29,041	31,660	--	United Arab Emirates 10,196; Libya 7,459; Saudi Arabia 4,477.
Refinery products:				
Gasoline including natural do	r16,251	15,638	(2)	Italy 4,341; France 4,103; Belgium-Luxembourg 3,649.
Distillate fuel oil do	6,668	6,671	15	Italy 1,868; U.S.S.R. 1,590; France 1,257.
Residual fuel oil do	41,202	36,482	--	U.S.S.R. 12,788; France 8,515; Netherlands 5,834.
Lubricants do	r35	37	3	West Germany 20; Belgium-Luxembourg 3; France 2.
Other:				
Liquefied petroleum gas do	8,139	8,904	--	Netherlands 6,568; West Germany 2,318.
Mineral jelly and wax do	109	117	2	West Germany 69; France 17; Hungary 7.

See footnotes at end of table.

Table 3.—Switzerland: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Other —Continued				
Pitch and pitch coke thousand 42-gallon barrels	62	74	--	Czechoslovakia 50; France 19; West Germany 4.
Petroleum coke ------do----	331	553	294	West Germany 259.
Bitumen and other residues and bituminous mixtures, n.e.s. do----	1,198	1,185	(2)	France 683; West Germany 354; Italy 127.
White spirit ---------do----	130	146	(2)	France 61; Netherlands 52; Italy 14; West Germany 13.
Total ----------do----	r74,125	69,807		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals----------	26,963	28,827	877	France 10,835; Netherlands 6,978; West Germany 5,723.

rRevised. NA Not available.
[1]Excluding the Canal Zone.
[2]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Swiss Aluminium Ltd. announced plans to invest about 250 million Swiss francs in new technology in its Chippis (30,000 tons per year) and Steg (48,000 tons per year) plants. Modifications will enable both plants to meet environmental standards, and in addition, the investment at Chippis will cover, in part, replacement of some electrolytic cells by an experimental installation that should have a capacity of 5,700 tons per year of aluminum. No details on the kind of technology used were available.

During 1980, three aluminum plants were in operation in Switzerland with an aggregated capacity of 88,000 tons of aluminum per year. In addition to the two plants mentioned above, a third one, at Martigny (10,000 tons per year) was operated by Usine d'Aluminium Martigny S.A. All plants processed imported alumina.

Iron and Steel.—One of the four steel producers in Switzerland, S.A. Von Moos, announced plans to invest about 120 million Swiss francs in a new combination bar and rod mill to be located at Littau, Lucern Canton. The new mill, to be built by West Germany's Schloemann-Siemag, was planned to replace an existing one that is reportedly outdated. Plans called for beginning production in 1981 at an annual capacity of 265,000 tons of products per year or 65,000 tons more than the existing plant.

In addition to S.A. Von Moos, Monteforno Acciaierie e Laminatoi S.A., Von Roll Ltd., and Ferrowohlen AG produced steel during 1980. Total steel capacity of all four companies was 700,000 tons per year.

NONMETALS

During 1980, the nonmetals sector of the mineral industry in Switzerland had an uneventful year. Table 1 shows the most recent trends in production of nonmetals.

MINERAL FUELS

Again, as in the past, imported primary energy carriers were the major sources of energy in Switzerland during 1980. Domestic output was limited to hydropower and noncommercial fuels, including waste products. During 1979, the last year for which complete data were available, petroleum remained by far the major source followed by hydropower (18% of total consumption), nuclear power (15%), imported natural gas (4%), and coal, wood, and industrial waste (each 1%).

Petroleum and Natural Gas.—Switzerland did not produce oil and gas during

1980. Some exploration, mostly geophysical, was conducted in the pre-Alpine and Jura regions.

Three petroleum refineries, La Raffinerie du Sud-Ouest S.A., at Collombey, La Raffinerie de Cressier S.A. at Cressier, and La Raffinerie Rheintal AG, were operating and processed about 4.5 million tons of crude petroleum. Output of petroleum refinery products covered about 34% of the total demand.

Uranium.—Construction of four nuclear powerplants continued during 1980 in Switzerland. A local referendum was held in September in Zurich Canton. As a result, completion of the Kaiseraugust nuclear plant was approved. Although the vote was close, it was taken as a sign that anti-nuclear sentiment in Switzerland has peaked.

Total capacity of nuclear plants, both operational and under construction, was 4,500 megawatts electric.

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[1]Physical scientist, Branch of Foreign Data.

☆ U.S. GOVERNMENT PRINTING OFFICE-1981-361-603/619

The Mineral Industry of Taiwan

By Edmond Chin[1]

Taiwan's gross national product (GNP) for 1980 was estimated at $39,570 million[2] at current market prices and at $27,800 million at 1976 prices, compared with $32,346 million and $26,138 million, respectively, for 1979.[3] During 1978-80, GNP grew at about 20.6% annually at current prices; real growth during the period was, however, 9.5% annually. Per capita, GNP at current prices reached $2,246 in 1980, a growth of 21.1% over that of 1979. Estimated total trade in 1980 was valued at $40 billion, comprised of $19.6 billion for exports and $20.4 billion for imports. The value of exports as share of GNP continued to rise from 53.5% in 1978, to 53.9% in 1979, and to 56.0% in 1980. Taiwan's median family income, one of the highest in Asia, was $5,753 in 1980, compared with $4,574 in 1979.

Despite its dependency on foreign raw materials, i.e., minerals and fuels, Taiwan's industrial production index grew by about 11.4% in 1980, compared with 12.4% in 1979. Manufacturing, the largest component of industrial production, grew by 10.1% in 1980. The most vigorous growth was by public utilities (electricity, gas, and water), which grew by 21.6%. Growth in the construction sector registered 10.4%. The index of industrial production for mineral-related components of the economy (1976=100) are given in the following table.

Sector	1977	1978	1979	1980
Mining:				
Coal	91.4	89.2	84.1	78.9
Petroleum and natural gas	102.9	100.3	93.8	91.9
Metal	88.9	107.8	106.6	127.9
Miscellaneous mining and quarrying	120.1	123.3	137.6	168.8
Chemicals:				
Basic chemicals	109.6	126.1	148.5	149.1
Petrochemicals	139.8	194.1	242.0	250.8
Fertilizers	105.0	125.9	127.9	133.9
Nonmetallic mineral products:				
Cement	118.2	131.1	136.0	158.5
Cement products	103.5	104.2	112.8	130.5
Structural clay products	108.4	118.8	107.8	112.7
Basic metals:				
Iron and steel, primary	142.6	192.0	231.4	205.6
Aluminum, primary	111.2	159.3	169.3	169.9
Overall industrial index	112.9	141.0	153.4	164.8

Except for construction raw materials, Taiwan is deficient in many minerals. Additionally, domestic mine output is insignificant in terms of the world market. While the value of mine output has increased annually since 1976, this was a result of higher world prices rather than an increase in the quantity of mine output. In 1980, the mineral-processing sector outweighed the domestic mining sector 21-to-1 in output value compared with a 25-to-1 ratio in 1979, as shown in the following tabulation:

Sector	1976	1977	1978	1979	1980
Mining:					
Coal	4,388	4,043	4,072	4,311	5,700
Crude petroleum and natural gas	4,420	4,472	4,331	6,055	10,100
Metal mining	1,022	912	1,032	1,323	1,900
Miscellaneous mining and quarrying	1,566	1,825	1,962	2,337	3,300
Total	11,396	11,252	11,397	14,026	21,000
Manufacturing:					
Chemical materials and products	63,068	77,050	95,744	136,652	146,900
Petroleum and coal products	47,732	57,132	68,560	87,560	148,800
Nonmetallic mineral products	22,322	26,128	31,078	36,095	48,600
Basic metals	29,030	39,340	62,288	83,185	90,700
Metal products	5,066	6,036	8,013	9,676	13,300
Total	167,218	205,686	265,683	353,168	448,300

In 1979, employment in the mining and quarrying sector was 54,631, working a monthly average of 182 hours. Average monthly earnings in the mining sector was NT$9,243 in 1979, compared with NT$7,872 in 1978. Earnings by miners in 1979 has increased by 46.7% compared with 1976.

In early September 1980, the Council for Economic Planning and Development adopted a 4-year period as a cycle for implementing Taiwan's 10-year development plan (1980-89). The 4-year cycle was adopted because a shorter period was expected to have better flexibility to cope with a changing situation in the international market. A shorter period to carry out an intermediate plan in the long-term economic plan would be easier, and State enterprises preferred the 4-year period for an intermediate program.

Under the 10-year development plan,[3] the output value of the mining sector was projected to increase $350 million in 1979 to $439 million in 1984, and to $539 million in 1989. However, the mining input to the gross domestic product was to decrease from 1.1% in 1979 to 0.9% in 1984, and to 0.7% in 1989. The structure of the manufacturing sector was designed as follows, in percent:

Component	1979	1984	1989
High technology products	23.9	28.6	34.0
Metals and minerals	13.5	15.2	16.8
Iron and steel	3.6	4.2	4.7
Other metals	5.7	6.9	8.1
Other minerals	4.2	4.1	4.0
Chemical and petrochemical	26.1	24.1	21.5
Petroleum products	4.8	4.1	3.7
Petrochemical feedstocks	1.9	2.0	1.8
Other chemicals	19.4	18.0	16.0
Other industries	36.6	32.1	27.7
Value of total manufacturing, millions	$13,801.3	$22,844.8	$36,802.6

Total fixed investment in the mining sector was estimated at $0.4 billion in 1980-84 and $0.7 billion in 1985-90, compared with $20.2 billion and $30.8 billion, respectively, for manufacturing. Employment in the mining sector was projected to decrease from 63,000 in 1979 to 55,000 in 1984, and to 48,000 in 1989.

Of the 120 major investment projects planned by the Government at a total cost of $86 billion, only 2 involved mining—offshore oil exploration ($428 million) and cement ($94 million)—constituting about 0.6% of total investment funds. A total of $5,580 million was to be allocated for second-stage construction of China Steel Corp. (CSC) and $106 million for a zinc smelter. Investment for 18 chemical and petroleum projects totaled $3,347 million.

PRODUCTION

Coal was the most important mineral commodity mined in Taiwan. However, output of bituminous coal has decreased annually since 1976, declining to about 2.5 million tons in 1980. Domestic production of crude petroleum and natural gas is negligi-

ble. The only minerals domestically mined of significant quantity include china clay, dolomite, feldspar, fire clay, limestone, marble, salt, and serpentine. Only small amounts of metal ores are produced domestically, notably copper, gold, and silver. The mining index (1976=100) for 1980 was estimated at 101.0 compared with 96.2 for 1979 and 97.3 for 1978.

Table 1.—Taiwan: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Alumina, gross weight	r48,000	r51,047	51,000	58,000	e65,000
Metal, primary	25,512	29,740	50,512	56,218	63,549
Sheet	18,617	r20,295	25,421	26,061	21,748
Copper:					
Mine output, metal content	2,000	2,000	800	800	e1,200
Metal:					
Smelter, secondary	11,700	11,500	13,000	14,300	e17,000
Refined, secondary	11,660	11,511	14,541	15,305	19,303
Gold metal, primary troy ounces	26,952	14,995	13,407	14,243	13,278
Iron and steel:					
Iron ore	--	32,427	--	--	--
Metal					
Pig iron	r190,938	r275,027	316,123	324,908	271,644
Ferroalloys: Ferrosilicon	23,342	24,672	29,785	37,500	35,326
Crude steel	634,485	910,480	1,268,822	1,570,185	1,411,905
Lead metal, smelter, secondary[e]	r8,000	r10,000	r14,000	r20,000	16,800
Silver metal, primary	99,969	67,905	75,316	85,383	95,073
NONMETALS					
Asbestos	853	673	2,031	2,957	683
Cement, hydraulic thousand tons	r8,757	r10,334	11,461	11,897	14,062
Clays:					
Kaolin	27,484	29,230	66,180	85,041	79,802
Fire clay	12,972	23,477	24,889	48,539	48,048
Feldspar	12,567	16,219	15,757	24,403	25,149
Gypsum:					
Precipitated	1,578	2,325	1,526	2,535	3,364
Other	r725	5,087	1,859	--	4,706
Lime thousand tons	164	r178	191	177	199
Mica	448	1,334	1,388	1,150	338
Nitrogen: N content of ammonia	319,619	325,485	438,605	390,923	414,350
Pyrite and pyrrhotite (including cuprous), gross weight	9,386	7,304	767	536	150
Salt, marine thousand tons	497	496	341	366	722
Sodium compounds, n.e.s.:					
Caustic soda	267,096	301,047	362,180	419,545	400,086
Sodium carbonate (soda ash)	r79,724	r80,050	76,992	80,715	92,540
Stone:					
Dolomite thousand tons	172	284	417	530	489
Limestone do.	9,612	11,679	12,857	13,126	12,822
Marble thousand cubic meters	1,245	1,620	1,641	1,976	2,839
Serpentine	r15,639	r26,398	35,580	50,915	102,927
Sulfur:					
Native, elemental	r(3)	r(3)	(3)	(3)	--
S content of pyrite	r3,423	r2,664	298	195	55
Byproduct, all sources	r5,470	r7,778	9,506	8,940	8,099
Total	r8,893	r10,442	9,804	9,135	8,154
Talc and related materials: Soapstone	15,481	10,160	9,946	11,194	9,911
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	e2,200	2,500	9,501	12,983	15,070
Coal, bituminous thousand tons	3,236	r2,956	2,884	2,720	2,574
Coke do.	228	229	236	240	227
Gas, natural:[4]					
Gross million cubic feet	64,824	66,609	64,999	60,759	60,329
Marketed do.	e63,500	64,950	e63,400	e59,000	e58,600
Natural gas liquids:					
Liquefied petroleum gas (from natural gas) thousand 42-gallon barrels	e600	e700	731	750	NA
Natural gasoline do.	e500	e1,000	884	900	NA
Petroleum:					
Crude do.	1,555	1,597	1,552	1,451	1,330
Refinery products:					
Gasoline do.	8,500	9,778	11,383	12,560	13,086
Kerosine do.	918	320	--	79	--
Distillate fuel oil do.	15,189	16,262	20,533	20,643	22,418
Residual fuel oil do.	43,067	48,573	58,264	57,525	63,988

See footnotes at end of table.

Table 1.—Taiwan: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other:					
Lubricants					
thousand 42-gallon barrels	657	760	917	945	857
Asphalt do	1,679	2,308	2,420	1,715	1,749
Other[5] do	4,364	4,374	7,905	5,304	2,595
Refinery fuel, losses, and not reported[6] do	5,587	10,378	7,965	7,760	[e]8,225
Total do	79,961	92,753	109,387	106,531	112,918

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Includes data available through June 23, 1981.
[2]In addition to the commodities listed, tin and zinc may be produced, but statistical information is not available.
[3]Less than 1/2 unit.
[4]Largely processed into natural gas liquids.
[5]Naphtha, solvent oil, and base oil.
[6]Includes liquefied petroleum gas and jet fuel among "not reported."

TRADE

Taiwan's two-way trade in 1980 was estimated to total $29.5 billion. Exports increased 22.7%, reaching $19.8 billion in 1980 while imports increased 33.5% to $19.7 billion. Industrial products accounted for 90.6% or $17.95 billion of the total value of exports followed by agricultural products, $1.81 billion. Imports of agricultural and industrial raw materials during the year were valued at $13.96 billion or 70.8% of the total value of imports; followed by capital goods, $4.62 billion; and consumer goods, $1.14 billion.

The value of total shipments to the United States totaled $6.75 billion; followed by Japan, $2.16 billion; and Hong Kong, $1.55 billion. Japan was Taiwan's major supplier of imports, providing $5.35 billion. Receipts from the United States were $4.67 billion, and from Kuwait, $2.24 billion. Taiwan's oil import bill in 1980 was $4.1 billion.

Table 2.—Taiwan: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide	2,380	104	2	Republic of Korea 100.
Metal including alloys, all forms	8,271	6,943	727	Hong Kong 2,266; Indonesia 1,644; Japan 965.
Copper:				
Copper sulfate	22	18	--	Singapore 13; Philippines 5.
Metal including alloys:				
Scrap	5,518	7,552	20	Japan 7,261.
Unwrought	428	236	42	Japan 194.
Semimanufactures	5,020	5,807	190	Hong Kong 1,478; Japan 1,344; Malaysia 690; Singapore 651.
Gold metal, all forms troy ounces	51,216	225,666	--	Republic of Korea 85,842; Philippines 79,541.
Iron and steel metal:				
Scrap	156,420	72,065	NA	Japan 49,387; Thailand 14,350.
Pig iron, ferroalloys, similar materials	20,082	21,406	88	Japan 10,500; Thailand 4,669; Indonesia 2,832.
Steel, primary forms	187,531	420,299	130	Japan 156,562; Indonesia 130,085; Philippines 43,629.

See footnotes at end of table.

Table 2.—Taiwan: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections:				
Wire rod and other bars and rods	359,947	617,690	11,946	Saudi Arabia 317,200; Hong Kong 130,451; Japan 20,770.
Angles, shapes, sections	42,086	25,962	2,516	Saudi Arabia 5,182; Hong Kong 3,990; Singapore 3,949; Indonesia 2,640.
Universals, plates, sheets	133,800	266,345	1,178	Japan 205,132; India 16,384; Singapore 13,025.
Hoop and strip	4,231	4,015	21	Indonesia 1,299; Hong Kong 664; Singapore 418.
Rails and accessories	2,241	11,211	--	Singapore 9,977; Malaysia 970.
Wire	11,561	12,194	176	Thailand 2,389; Philippines 2,150; Saudi Arabia 1,455; Singapore 804.
Tubes, pipes, fittings	150,801	158,480	67,467	Saudi Arabia 32,215; Hong Kong 11,118.
Castings and forgings, rough	11,925	11,703	5,887	Indonesia 1,790; Philippines 1,189.
Lead metal including alloys, all forms	5,584	11,423	2	Japan 7,581; Republic of Korea 1,790; Hong Kong 897.
Magnesium metal including alloys, all forms	274	295	271	Canada 18.
Manganese oxides	5	7	--	All to Singapore.
Nickel:				
Matte, speiss, similar materials	146	51	15	Japan 36.
Metal including alloys:				
Scrap	349	641	66	Japan 575.
Unwrought and semimanufactures	38	156	18	Japan 131.
Platinum-group metals and silver:				
Waste and sweepings kilograms	113	367	--	West Germany 365; United Kingdom 2.
Metal including alloys:				
Platinum-group troy ounces	4,372	57,871	--	Colombia 49,833; Republic of South Africa 8,038.
Silver do	32,376	22,956	22,827	West Germany 129.
Tin metal including alloys, all forms	104	113	(1)	Singapore 38; Hong Kong 33; Japan 27.
Titanium oxides	468	(1)	--	Mainly to Thailand.
Tungsten (wolfram) metal including alloys, all forms	20	10	2	West Germany 4; Japan 3.
Zinc:				
Oxide and peroxide	1,015	1,369	--	Japan 902; Philippines 427.
Metal including alloys, all forms	280	597	151	Japan 394.
Other:				
Ash and residue containing nonferrous metals	17,344	524	--	Japan 488; Singapore 35.
Oxides, hydroxides, peroxides, n.e.s	72	91	48	Australia 16; Canada 16.
Metals including alloys, all forms:				
Metalloids: Silicon	--	17	--	Indonesia 10; Hong Kong 5.
Pyrophoric alloys kilograms	--	84	--	All to Dominican Republic.
Base metals including alloys, all forms, n.e.s	90	106	19	Hong Kong 43; Nigeria 18; Kuwait 13.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, natural corundum, etc	19	3	--	Japan 2; Republic of Korea 1.
Dust and powder of precious and semi-precious stones kilograms	1,171	304	150	Hong Kong 50; Japan 48.
Grinding and polishing wheels and stones	2,038	2,354	340	Thailand 705; Singapore 309; Philippines 210.
Artificial corundum	6	19	--	Indonesia 8; Republic of South Africa 6; Thailand 5.
Barite and witherite	2	30	--	All to Philippines.
Boron materials: Oxide, acid, refined borates, perborates	37	35	--	Mainly to Hong Kong.
Cement thousand tons	1,146	353	--	Hong Kong 187; Thailand 50; Kuwait 39.
Clays and clay products (including all refractory brick):				
Crude:				
Kaolin	--	30	--	All to Japan.
Bentonite	27	80	--	Hong Kong 50; Japan 27.
Fire clay	18	20	--	All to Republic of Korea.
Other	231	168	--	Singapore 71; Indonesia 50; Thailand 20.
Products:				
Refractory (including nonclay brick)	5,986	6,371	1	Indonesia 2,253; Philippines 1,346; Hong Kong 1,054.
Nonrefractory	25,054	20,980	268	Hong Kong 12,336; Malaysia 1,841; Singapore 1,598.

See footnotes at end of table.

Table 2.—Taiwan: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond, gem:				
Not set or strung ____ thousand carats__	15	2,675	135	Republic of South Africa 2,515.
Manufactured _____ do____	545	2,455	280	Kuwait 1,025; Italy 595.
Diatomite and other infusorial earth_____	123	50	__	All to Japan.
Feldspar and fluorspar _____	121	24	__	Indonesia 23; Hong Kong 1.
Fertilizer materials:				
Manufactured:				
Nitrogenous _____	8,000	47,062	__	Philippines 35,562; Bangladesh 5,700.
Potassic_____	100	__		
Other including mixed_____	247	11,382	__	Thailand 11,000.
Ammonia _____	3	9	__	Thailand 6; Hong Kong 3.
Graphite, natural _____	785	615	__	Japan 503; Netherlands 51; Thailand 48.
Gypsum and plasters _____	1,564	2,045	4	Indonesia 2,000.
Lime _____	1,640	1,682	__	Hong Kong 982; Malaysia 500.
Mica, all forms _____	20	112	__	Australia 61; United Kingdom 34; New Zealand 17.
Pigments, mineral: Iron oxides, processed___	53	93	__	Thailand 73.
Precious and semiprecious stones except diamond:				
Natural _____ kilograms__	45,952	7,676	5,885	Hong Kong 952; Italy 383.
Manufactured _____ do____	60,489	59,002	9,239	West Germany 19,132; United Kingdom 16,488.
Salt and brines _____	12,377	16,106	__	Hong Kong 14,250; Malaysia 896.
Sodium and potassium compounds, n.e.s____	53,587	46,371	__	Republic of Korea 31,408; Japan 5,010; Thailand 4,256.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked _____	12,603	61,884	64	Japan 60,985.
Worked _____	17,817	20,370	1,702	Japan 13,295; Saudi Arabia 2,281.
Dolomite, chiefly refractory grade _____	21,390	80,133	__	Japan 77,133.
Gravel and crushed rock, n.e.s_____	152,158	229,082	__	Japan 218,677; Ryukyu 10,000.
Limestone except dimension_____	2,662	2,388	__	Hong Kong 2,255.
Quartz and quartzite _____	6	__		
Sand excluding metal-bearing_____	81,418	111,800	__	Japan 110,050.
Sulfur:				
Elemental:				
Colloidal _____	188	139	__	Singapore 95; Philippines 20; Thailand 20.
Other than colloidal _____	2,252	3,695	__	Indonesia 2,048; Philippines 490.
Sulfuric acid including oleum _____	2,046	3,858	__	Hong Kong 3,056; Bahrain 402.
Talc, steatite, soapstone, pyrophyllite _____	1,812	1,401	__	Indonesia 430; Malaysia 420; Thailand 185.
Other:				
Crude:				
Meerschaum, amber, jet_____	2	__		
Other _____	4,180	552	8	Japan 225; Indonesia 180.
Slag, dross, and similar waste, not metal bearing: Slag and ash_____	1,469	4,608	__	Singapore 2,701; Philippines 1,531.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s _____	5,873	2,307	177	Hong Kong 807; Thailand 402; Saudi Arabia 301.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black and gas carbon:				
Carbon black _____	799	1,762	__	Thailand 1,197; Indonesia 533.
Gas carbon _____	11	11	__	Hong Kong 10.
Coal _____	30	230	__	Indonesia 150; Philippines 80.
Coke and semicoke_____	10,102	11,495	__	Indonesia 5,360; Malaysia 3,140; Singapore 1,850.
Rare gases: Argon _____ kilograms__	1,980	1,298	__	All to Philippines.
Petroleum refinery products:				
Gasoline__ thousand 42-gallon barrels__	1,767	476	171	Thailand 238.
Kerosine, jet fuel, white spirit ___ do____	3,218	2,305	__	Indonesia 819; Hong Kong 397.
Distillate fuel oil _____ do____	3,835	2,848	[illegible]	Japan 1,597; Thailand 533.
Lubricants _____ do____	132	54	(1)	Saudi Arabia 14; Indonesia 12; Singapore 12.
Other:				
Nonlubricating oils, n.e.s ___ do____	14	14	__	Thailand 6; Hong Kong 2.
Pitch and pitch coke _____ do____	24	18	__	Thailand 14.
Total _____ do____	8,990	5,715		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals_____	201,316	178,487	__	Japan 152,575; Republic of Korea 10,391.

[r]Revised. NA Not available.
[1]Less than 1/2 unit.

Table 3.—Taiwan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	171,182	209,618	--	Malaysia 182,702; Australia 25,781.
Oxide and hydroxide	42,579	67,528	74	Australia 40,088; Japan 26,582.
Metal including alloys:				
Scrap	10,103	13,762	11,817	Hong Kong 1,219; West Germany 296; Singapore 241.
Unwrought	48,672	52,860	6,460	Bahrain 19,430; Republic of South Africa 6,624; Ghana 5,282.
Semimanufactures	7,403	11,165	1,198	Japan 6,573; Italy 1,500; France 567; Canada 513.
Arsenic:				
Natural sulfides	3	10	NA	NA.
Trioxide, pentoxide, acids	213	682	61	France 308; Belgium 210; West Germany 66.
Beryllium metal including alloys, all forms kilograms	--	8	8	
Chromium:				
Chromite	3,327	6,653	--	India 2,832; Philippines 2,231; Republic of South Africa 1,590.
Oxide and hydroxide	1,561	1,548	702	Japan 548; West Germany 280.
Cobalt oxide and hydroxide	31	17	(1)	Belgium 7; Japan 5; Canada 3.
Columbium and tantalum: Tantalum metal including alloys, all forms kilograms	501	33	9	Japan 24.
Copper:				
Ore and concentrate	20,654	61,106	--	Philippines 39,189; Chile 21,917.
Matte	5	35	17	Hong Kong 9.
Copper sulfate	236	245	27	Japan 196; New Zealand 18.
Metal including alloys:				
Scrap	14,014	16,297	13,147	Hong Kong 1,626; Canada 523; Singapore 231; Philippines 207.
Unwrought	38,891	56,945	1,459	Japan 25,466; Chile 19,047; Republic of South Africa 5,633; Peru 4,202.
Semimanufactures	21,076	26,886	1,209	Japan 23,925; West Germany 674.
Germanium metal including alloys, all forms kilograms	104	(2)	--	All from Japan.
Gold:				
Metal, unworked or partly worked thousand troy ounces	262	175	105	Japan 39; Singapore 25.
Bullion do	40,092	508,364	--	Switzerland 307,505; United Kingdom 200,858.
Iron and steel:				
Ore and concentrate thousand tons	2,489	2,649	--	Australia 1,775; Brazil 279; Republic of South Africa 219.
Roasted pyrite	74,209	50,980	--	All from Philippines.
Metal:				
Scrap	622,219	760,660	470,215	Hong Kong 238,579; Australia 13,479.
Pig iron, ferroalloys, similar materials	75,773	79,232	186	Hong Kong 43,800; Sweden 18,328; Republic of South Africa 4,945.
Steel, primary forms	27,255	74,462	15,572	Republic of Korea 21,057; West Germany 12,406.
Semimanufactures:				
Bars, rods, angles, shapes, sections	279,669	277,869	2,705	Japan 225,083; Republic of South Africa 39,603.
Universals, plates, sheets thousand tons	1,165	1,467	77	Japan 1,065; Republic of South Africa 144; Republic of Korea 101.
Hoop and strip	27,495	16,744	1,693	Japan 13,805.
Rails and accessories	6,145	2,920	--	Japan 2,751.
Wire	12,507	12,615	1,850	Japan 7,700; Republic of Korea 2,140.
Tubes, pipes, fittings	44,998	52,000	9,077	Japan 37,869.
Castings and forgings, rough	1,092	1,627	422	Japan 1,038.
Lead:				
Oxides	2,210	3,701	283	Australia 2,066; Mexico 1,074.
Metal including alloys:				
Scrap	22,061	46,805	23,100	Australia 7,918; Japan 5,857; Kuwait 2,635.
Unwrought	8,794	8,856	446	Australia 5,280; Japan 1,438; Peru 702.
Semimanufactures	425	476	30	United Kingdom 139; Republic of South Africa 111; Japan 47.
Magnesium metal including alloys, all forms	1,938	217	2	Japan 124; Norway 74; Canada 17.
Manganese:				
Ore and concentrate	96,254	148,013	--	Republic of South Africa 41,174; Gabon 35,410; Malaysia 27,120.
Oxides	3,307	2,320	18	Japan 874; Gabon 516; Singapore 368; Belgium 274.
Metal	36	52	2	Republic of South Africa 31; Japan 19.
Mercury 76-pound flasks	2,665	1,644	174	Japan 611; West Germany 605; Spain 145.

See footnotes at end of table.

Table 3.—Taiwan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Molybdenum metal including alloys, all forms	40	48	39	Japan 7.
Nickel metal including alloys, all forms	4,667	2,889	45	Canada 1,630; Norway 388; Japan 375.
Platinum-group metals and silver:				
Ores and concentrates—value	$35,165	$60,782	--	All from United Kingdom.
Bullion, silver—thousand troy ounces	12,860	--		
Metals including alloys:				
Platinum-group—do	131	290	6	West Germany 210; Japan 57.
Silver—do	2,068	4,078	283	Japan 2,180; Switzerland 735; West Germany 588.
Selenium, elemental—kilograms	4,862	4,923	1	Japan 4,714.
Silicon metal	2,521	118	5	France 49; Norway 20; Republic of South Africa 17.
Tin:				
Ore and concentrate	60	7	--	All from Malaysia.
Oxides—kilograms	753	404	--	All from Japan.
Metal including alloys, all forms	3,874	1,328	76	Malaysia 543; Hong Kong 332; Japan 163.
Titanium oxides	16,334	16,123	2,036	Japan 7,648; West Germany 2,801.
Tungsten metal including alloys, all forms	24	38	5	Japan 29.
Uranium and thorium oxides	1	31	31	
Zinc:				
Oxide and peroxide	911	1,132	45	Canada 594; Japan 169; Australia 164; West Germany 157.
Metal including alloys:				
Scrap	7,826	15,756	13,771	Canada 959; Japan 415; Australia 242.
Blue powder	65	76	(1)	Mainly from Japan.
Unwrought	50,868	37,350	117	Australia 25,169; Japan 5,121; Canada 4,067.
Semimanufactures	1,332	668	26	Japan 391; West Germany 118; Netherlands 53; Belgium 52.
Other:				
Ores and concentrates:				
Of molybdenum, tantalum, titanium, vanadium, zirconium	22,823	48,543	--	India 29,700; Malaysia 12,702; Australia 5,704.
Of base metals, n.e.s	50	13	1	Hong Kong 4.
Ash and residue containing nonferrous metals	18,032	19,113	9,993	Australia 3,495; Singapore 944; Philippines 915.
Oxides, hydroxides, peroxides, n.e.s	931	1,020	45	Japan 383; France 200; United Kingdom 124; West Germany 92.
Metals including alloys, all forms:				
Metalloids, n.e.s	74	203	18	Republic of South Africa 98; Japan 47; West Germany 32.
Alkali, alkaline-earth, rare-earth metals	147	290	18	Japan 123; West Germany 38; United Kingdom 26.
Pyrophoric alloys—kilograms	2,528	4,300	--	West Germany 1,300; Austria 1,200; Australia 1,000.
Base metals including alloys, all form, n.e.s	435	448	52	Japan 187; France 41; Netherlands 30; Republic of South Africa 25.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, natural corundum, etc	2,391	3,274	1,015	Japan 1,469; Republic of South Africa 420.
Dust and powder of precious and semi-precious stones—kilograms	265	6,524	59	Japan 6,252; Netherlands 198.
Grinding and polishing wheels and stones	581	710	34	Japan 356; Italy 276.
Artificial corundum	6,060	6,039	752	Japan 4,690; India 332; West Germany 124.
Asbestos	24,892	29,103	23	Republic of South Africa 14,489; Canada 13,971.
Barite and witherite	10,340	2,870	--	All from Thailand.
Boron materials:				
Crude natural borates	720	1,098	--	All from Netherlands.
Oxide, acid, refined borates, perborates	7,412	8,285	8,174	Japan 99; France 10.
Bromine—kilograms	5,708	18	--	Australia 16; West Germany 2.
Cement	11,884	9,874	32	Japan 9,819.
Clays and clay products (including all refractory brick):				
Crude:				
Bentonite	5,077	6,893	6,273	Republic of South Africa 278; Japan 219.
Fire clay	1,707	2,180	183	Japan 1,719.
Kaolin	42,171	40,425	11,216	Republic of Korea 17,457; Malaysia 3,815.
Other	111,271	150,218	22,052	Japan 64,960; Hong Kong 48,212; India 5,100.

See footnotes at end of table.

Table 3.—Taiwan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products (including all refractory brick) —Continued				
Products:				
Refractory (including nonclay brick)	12,407	31,590	1,053	Japan 16,078; West Germany 9,053; Republic of South Africa 1,500.
Nonrefractory	12,909	17,866	69	Italy 16,289.
Cryolite and chiolite	3	1	--	All from Japan.
Diamond:				
Gem:				
Not set or strung, thousand carats	1,135	165	110	France 40.
Manufactured, do.	26,965	315	210	Canada 50; France 50.
Industrial:				
Natural, do.	1,555	[3] 230	45	Japan 185.
Manufactured, do.	45	90	35	Belgium 35; Switzerland 20.
Diatomite and other infusorial earth	2,285	3,072	2,246	Japan 665.
Feldspar and fluorspar	42,820	44,221	166	Thailand 13,952; Republic of Korea 13,420; Japan 8,276.
Fertilizer materials:				
Crude, phosphatic	287,758	359,569	86,222	Jordan 250,400; Israel 12,215; Singapore 10,732.
Manufactured:				
Nitrogenous	15,694	2,408	--	Japan 2,300.
Phosphatic	5	3	--	All from West Germany.
Potassic	107,110	161,647	19,550	Canada 107,644; Israel 25,137.
Other including mixed	220	250	77	Japan 89; United Kingdom 35; West Germany 31.
Ammonia	17	41	38	Hong Kong 2.
Graphite, natural	9,402	13,722	104	Republic of Korea 11,360; Sri Lanka 1,511.
Gypsum and plasters:				
Gypsum	232,720	289,752	--	Japan 210,663; Republic of Korea 48,800; Mexico 26,320.
Plasters	2,178	3,079	244	Japan 2,766.
Iodine, kilograms	6,191	7,169	57	Japan 7,030.
Lime	1	--		
Mica:				
Crude including splittings and waste	436	524	2	West Germany 152; Japan 135; India 94.
Worked including agglomerated splittings	84	99	13	Japan 65; India 13.
Pigments, mineral:				
Natural, crude	53	133	--	All from Japan.
Iron oxides, processed	6,781	8,497	49	Japan 6,408; West Germany 1,453; Netherlands 293.
Precious and semiprecious stones, except diamond:				
Natural, kilograms	992,968	945,961	2,789	Canada 391,861; Brazil 259,600; Republic of South Africa 107,264.
Manufactured, do.	2,878	6,023	74	Italy 3,225; Japan 1,229; West Germany 642.
Salt and brines	492,751	677,456	--	Australia 647,357; Austria 30,062.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	97	27,630	27,544	Japan 59; Sweden 26.
Caustic potash and sodic and potassic peroxides	1,218	1,443	[1]	Japan 1,387; West Germany 19.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	14,451	15,681	NA	Italy 3,238; Portugal 2,128; India 1,724.
Worked	5,614	3,112	457	Italy 2,453.
Dolomite, chiefly refractory grade	22,756	860	110	Japan 750.
Gravel and crushed rock, n.e.s	2,583	2,867	18	France 2,504.
Limestone except dimension	[1]	6	--	All from Japan.
Quartz and quartzite	553	824	--	Republic of Korea 400; Sweden 229; Belgium 98.
Sand, excluding metal bearing	1,336	2,000	106	Japan 1,386; Australia 487.
Sulfur:				
Elemental:				
Colloidal	187,499	130,629	273	Canada 76,765; Japan 53,562.
Other than colloidal	176,855	186,479	--	Canada 154,054; Japan 32,425.
Sulfur dioxide	38	52	--	Mainly from Japan.
Sulfuric acid including oleum	16	15,912	21	Japan 15,886.
Talc, steatite, soapstone, pyrophyllite	3,943	5,297	715	Republic of Korea 2,920; India 681; Japan 431.
Other:				
Crude:				
Meerschaum, amber, jet, kilograms	9,296	3,633	--	Japan 1,000.
Other	91,076	143,080	3	Republic of Korea 108,889; Japan 24,045.

See footnotes at end of table.

Table 3.—Taiwan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Other —Continued				
Slag, dross, and similar waste, not metal bearing:				
From iron and steel manufacture	64,039	29,736	19	Japan 21,305; Hong Kong 4,970.
Slag and ash, n.e.s	28	63	20	United Kingdom 36; Japan 7.
Oxides and hydroxides of magnesium, strontium, barium	9,351	14,344	329	Japan 13,874; West Germany 68.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	449	1,044	212	Japan 747; France 70.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	169	128	62	West Germany 66.
Carbon black and gas carbon:				
Carbon black	11,959	18,000	8,337	Australia 8,490; Philippines 468.
Gas carbon	(1)	NA		
Coal, all grades, including briquets thousand tons	1,369	2,720	412	Australia 1,609; Republic of South Africa 497.
Coke and semicoke	68,649	133,182	--	Japan 133,023.
Hydrogen and rare gases	1,605	1,738	9	Japan 1,575; Singapore 119.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	125,275	127,557	--	Kuwait 55,530; Saudi Arabia 54,844; United Arab Emirates 6,382.
Refinery products:				
Gasoline do	(1)	NA	NA	
Kerosine, jet fuel, white spirit do	--	NA	--	All from West Germany.
Distillate fuel oil do	16,938	11,773	1,462	Kuwait 8,181; Singapore 1,282.
Lubricants including grease do	465	553	246	Japan 231.
Other:				
Mineral jelly and wax do	81	95	6	Japan 54; Indonesia 26.
Nonlubricating oils, n.e.s do	68	784	52	Kuwait 373; Sri Lanka 217; Iran 89.
Liquefied petroleum gas do	959	1,372	--	Kuwait 496; Indonesia 453; Australia 186.
Pitch and pitch coke do	54	74	1	Japan 34; Australia 33.
Petroleum coke do	186	241	240	Japan 1.
Bitumen and other residues and bituminous mixtures, n.e.s do	2	2	1	NA.
Total do	18,753	14,894		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9,048	2,129	148	Republic of Korea 1,348; Japan 629.

NA Not available.
[1]Less than 1/2 unit.
[2]Value only reported at $915.
[3]Excludes quantity valued at $162,860.

COMMODITY REVIEW

METALS

Metal mining in Taiwan is insignificant and output is limited to only minor quantities of magnetite and pyrite, copper, and gold.

Iron and Steel.—In July 1978, CSC began construction of its second-stage expansion whereby the capacity of its integrated steelworks at Kaohsiung would be increased from 1.5 million tons of steel per year to 3.25 million tons per year in June 1982. Cost of the second-stage expansion program was estimated at NT$51.34 billion ($1.4 billion). On October 6, 1979, CSC concluded an $80 million loan agreement with a U.S. banking consortium headed by the Bank of America. Additionally, on January 14, 1980, CSC concluded two separate loan agreements; one with the U.S. Export-Import Bank for $212.5 million, and the other with a U.S. banking consortium headed by the National Bank of Pittsburgh for $40 million. The loan from the Export-Import Bank was to be repayable in 12.5 years,

and the loan from the consortium in 6.5 years. In November 1980, the Council for Economic Planning and Development approved a proposed investment increase of NT$4,466 million for CSC. Additional funds necessitated by cost overruns were caused by higher oil prices, inflation, upgrading of equipment and product specifications, and the purchase of 127 hectares of land needed for construction. Facilities to be added in the second-stage expansion included a material handling system; two batteries of coke ovens; a sintering plant; a 5,000-ton-per-day blast furnace; a basic oxygen furnace; two continuous casters; a hot strip mill; a cold strip mill; an oxygen plant; powerplant equipment, and a research center.

Other Metals.—Aluminum production was by Taiwan Aluminum Corp. (Talco), a wholly Government-owned company, integrated from alumina production through the metal-fabricating stage. Annual metal capacity is 75,000 tons per year.

Taiwan Metal Mining Corp. (TMMC), also a Government-owned company, operated an 18,000-ton-per-year copper smelter-refinery near its copper mine at Chinkuashih. TMMC started commercial operation of its 50,000-ton-per-year smelter-refinery at Keelung in August 1980.

NONMETALS

Cement.—Expansion programs completed in 1979-80 increased the country's cement production capacity to close to 14 million tons per year. Fuller Co. of the United States was providing all machinery and equipment for the 1,000-ton-per-day plant expansion of Ching Tai Cement. Fuller was also supplying equipment for the 3,000-ton-per-day expansion of the Kangsan plant of Chia Hsin Cement Corp. Polysius reportedly received a contract for major equipment for the new 2,200-ton-per-day plant of Hsin Hsin Cement Corp. of Taipei. KHD Humboldt Wedag of the Federal Republic of Germany completed the expansion to increase the output of the Huaben plant of Asia Cement Corp. to 5,200 tons per day. Also, F. L. Smidth completed the expansion of the 3,200-ton-per-day Suao plant of Taiwan Cement Co.

Other Nonmetals.—The major nonmetallic minerals produced in Taiwan include: China clay, dolomite, feldspar, fire clay, limestone, salt, serpentine, and talc. Small quantities of asbestos, gem stones, gypsum, and mica are also produced. Decorative marble was mined in eastern Taiwan. Marble deposits extend from Hualien County in a long, narrow vein that extends 20 kilometers from Suao in Ilan to Chihpen in Tantung. Maximum width of the vein is 10 meters and, in places, reaches a depth of 1,000 meters.

MINERAL FUELS

Taiwan produces only small quantities of coal, petroleum, and natural gas, and domestic energy output from all sources provides about 13.5% of the country's total energy supplies. In 1979, Taiwan energy supply-demand configuration was as follows, in 1,000 kiloliters of oil equivalence:

Domestic production:	
Coal	1,964.2
Natural gas	1,893.3
Hydropower	1,222.2
Crude oil	230.6
Imports:	
Crude oil	17,891.9
Petroleum products	3,647.3
Nuclear	1,693.7
Coal	1,653.0
Total	30,196.2
Domestic consumption:	
Petroleum products	15,144.8
Electric power:	
Thermal	7,666.8
Hydropower	1,222.2
Coal and coal products	2,348.0
Natural gas	1,828.5
Nuclear	1,693.7
Exports:	
Petroleum products	1,100.7
Coal and coal products	5.1
Inventory adjustment	(813.7)
Total	30,196.1

Energy consumed by the mining industry in 1979 was estimated at 1,598,200 kiloliters of oil equivalent; nonmetallic mineral products, 3,117,600 kiloliters; metallic products, 1,810,000 kiloliters; chemicals, 2,703,500 kiloliters; and for the energy sector, 3,251,700 kiloliters.

[1]Physical scientist, Branch of Foreign Data.
[2]All values are given in U.S. dollars unless otherwise indicated. The exchange rate in 1978, 1979, and 1980 was NT$36.00 = US$1.00.
[3]Airgram 019, American Institute in Taiwan, May 16, 1980, 26 pp.

The Mineral Industry of Tanzania

By Suzann C. Ambrosio[1]

Diamonds continued to be the most important mineral commodity produced in Tanzania during 1980. The mineral industry contributed approximately 1.3% to the country's real gross domestic product (GDP), estimated at $4.6 billion in 1980.[2] Nearly 90% of the value of mineral production and 50% of mineral export revenues were attributed to diamond sales.[3] Minerals produced on a small-scale basis, including cement, salt, kaolin, gypsum, and coal were of domestic significance only. Precious stones, mica, gold, and tin comprised the majority of mineral exports during the year.

The Tanzanian Government continued to play a large role in the mineral industry sector of the economy. A new ministry, solely responsible for developing the minerals sector was proposed, and the following strategies were being implemented: 1) gather geologic information, 2) propose mining legislation, 3) organize and coordinate the mining sector into several related institutions, and 4) actively pursue mine development programs. The Geology and Mineral Exploration Div. of the Ministry of Water, Energy, and Minerals was expected to carry out geological surveying, mapping, and sophisticated mineral exploration efforts. Petroleum exploration, development, and marketing were to continue to be carried out by the Tanzania Petroleum Development Corp. (TPDC) under joint venture agreements with foreign investment companies. The State Mining Corp. (STAMICO) was responsible for exploring new mineral deposits and developing and operating new mines and mineral-related activities. Government policy continued to stress majority shareholding in major mining operations.

Inadequate investment capital has consistently been a major factor adversely affecting mineral development activities in Tanzania. During the last decade, less than 2% of the country's budgeted development funds have been allocated to mineral projects. Proposed 1980-81 outlays for the Ministry of Water, Energy, and Minerals were divided among training programs, 2%; STAMICO, 3%; river basin authorities, 4%; mineral investigations, 6%; operating expenditures, 7%; water plans and investigations, 7%; TPDC, 15%; water supplies, 27%; and electricity supplies, 29%, of the total $115 million budget. The new Ministry of Mines budget was expected to receive increased funding, and the role of the private sector was expected to be enlarged with regard to mineral development activities. The Government planned to attract foreign investors through reorganization of mineral agencies, updating mining and investment legislation, and developing infrastructure and a trained labor force to support the mineral industries.

New mining legislation was passed in 1979 and became effective January 1, 1980. The law was divided into small-scale mining provisions and large-scale mining operations. Mineral rights were delineated for reconnaissance, prospecting, and mining. Mineral licensing provisions included 1 year for exploration activities (with renewals allowed for a maximum of 3 years); 3 years' exclusive rights for prospecting, upon approval of submitted minimum budget expenditures and work and training programs (with an optional renewal for two more periods of 2 years); and a 25-year (maximum life) mining license which would incorporate government participation.

Mineral investigations conducted during 1976 through 1980 focused on the explora-

tion of Tanzania's mineral deposits. Regional airborne geophysical surveys covered in excess of 1 million line kilometers. Data processing, interpretation, and final maps were being prepared during 1980. Airborne magnetic and ground follow-up surveys have identified possible kimberlitic intrusives. A number of greenstone belts in western Tanzania show encouraging potentials for gold and base metal deposits. Geosurvey International (Federal Republic of Germany) conducted the airborne survey and was expected to organize and train approximately 60 Tanzanians in mineral exploration methods for future ground follow-up studies.

The United Nations Development Program (UNDP) agreed to make available professionals to prepare a 20-year mineral development plan. UNDP has also provided financial assistance to the Eastern and Southern African Mineral Resource Development Center (ESAMRDC), including member countries Tanzania, Ethiopia, Mozambique, the Comoros, and Uganda. Professionals were being recruited in 1980 to construct and staff the headquarters, which was to be located in central Tanzania at Dodoma.

Tanzania received $625 million in bilateral and multilateral aid for 1980-81.[4] Nearly 60% of the assistance was in outright gifts, and approximately 75% of the aid was donated by the World Bank and Scandanavian countries. Foreign aid was expected to finance 70% of the country's development budget. In August 1980, the Government signed a 2-year, $235 International Monetary Fund (IMF) credit guarantee. By November 1980, nearly 20% of the credits were drawn for balance of payments assistance. The overall balance of payments deficit was estimated to have worsened by $40 million in 1980.

The trade deficit at yearend 1980 was estimated to have increased 32% over the previous year to $739 million. The value of imports increased because of high petroleum prices, despite a decrease in the volume of imports. The increased value of exports were primarily because of higher agricultural product prices, despite a decline in the volume of agricultural exports.

The national budget deficit was estimated at $230 million, and approximately 16% of the national income was consumed by the Government in 1980. Economic growth was hindered by corruption and inefficiencies within the 300 parastatal organizations and ministries. The World Bank reported in 1980 that Tanzania owed 25% of its gross national product for outstanding public debt. The Government's total indebtedness to the banking system increased by 73% in 1979 and continued to drive up inflation, running at approximately 20% in mid-1980. The breakup of the East African Community in 1977, the 1978-79 Ugandan war, and rapidly increasing oil import bills continued to adversely affect the Tanzanian economy in 1980. The war was estimated to have cost Tanzania $500 million.

PRODUCTION AND TRADE

The small-scale production of diamonds, gold, tin, tungsten, lead, mica, and a variety of gem stones continued to be the predominant mineral foreign exchange earners. Cement, salt, coal, kaolin, and meerschaum production continued to supply a significant portion of domestic industries' needs. STAMICO was investigating prospects for iron, coal, gold, fertilizer raw materials, kaolin, magnetite, beach sands, soda ash, and gypsum in 1980. Plans were made to expand production of these minerals over the next 5 years. Projects were undertaken in 1980 to develop medium-sized mines at Buck Reef and Lupa for gold, Minjingu for fertilizer raw materials, and large-scale mining at Songwe-Kiwira for coal, Pugu for kaolin, and Kilwa for gypsum.

The Tanzanian Government's 1980 production and trade statistics were not published, therefore, table 1 was based on projected production trends and available export data. The value of mineral exports increased by 43% between 1978 and 1979 to approximately $44.3 million. A 64.8% increase was recorded for petroleum product exports during the same period, equivalent to $16.7 million. Mineral exports represented approximately 8% and petroleum products comprised 3% of Tanzania's total exports in 1979. Diamonds contributed approximately one-half of the value of mineral exports during 1979.

Tanzania's relatively small export trade with the United States in 1979 was divided among agriculture and livestock (90%), unmanufactured minerals (3%), and other materials (7%). Nonferrous metals comprised the bulk or 67% of the Tanzanian-U.S. mineral trade by value. Diamond and gem stone exports to the United States declined by over 50% in value between 1979 and

1980. Exports of nonferrous metals also fell by over 10%.

Tanzania continued to import ferrous and nonferrous metals, fertilizer, and refractory materials for domestic industries. Imports of crude oil increased 43% between 1978 and 1979. A larger import bill was expected for 1980-81 because 60% of the country's oil, previously provided by Iraq, had to be purchased on the higher priced spot market. The total bill for crude oil, refined products, and other petroleum products for 1980 was projected to increase 80% to $360 million. Reexports of approximately 128,650 tons of residual fuel oil, 21,165 tons of bunker fuel oil, and small quantities of other refined products were expected to earn nearly $22 million in foreign exchange.

Crude oil imports accounted for over 50% of Tanzania's foreign exchange earnings in 1979-80. Import restrictions and cutbacks, imposed during 1979, continued in 1980 because of a lack of foreign exchange. Consequently, the vicious cycle of declining imports, especially of raw materials, was expected to continue to adversely affect the potential values of Tanzania's mineral production and trade.

Table 1.—Tanzania: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Gold, refined ___ troy ounces	10	23	133	322	[2]246
Silver, refined ___ do.	1	--	--	--	--
Tin, mine output, metal content	3	--	9	10	12
NONMETALS					
Cement	241,000	260,000	231,100	280,000	340,000
Clays:					
Bentonite	--	35	20	80	80
Kaolin[e]	1,000	1,000	1,000	1,100	1,100
Diamond:					
Gem[e 3] ___ carats	219,104	204,016	[r]140,894	[r]156,776	136,852
Industrial[e 3] ___ do.	219,105	204,016	[r]140,894	[r]156,775	136,853
Total ___ do.	438,209	408,032	281,788	313,551	[2]273,705
Gem stones, precious and semiprecious, except diamond:[4]					
Amethyst ___ kilograms	7	2	4	28	[2]48
Aquamarine ___ do.	([5])	NA	--	NA	[2]533
Beryl (gem only) ___ do.	46	67	--	2	[2]([5])
Chrysoprase and opal ___ do.	([5])	--	23	2	[2]([5])
Corundum (gem only) ___ do.	--	--	--	6	7
Garnet and rhodolite ___ do.	30	20	3	37	[2]9
Ruby and sapphire ___ do.	1	1	([5])	20	[2]10
Scapolite ___ do.	3	7	--	9	10
Tourmaline ___ do.	13	3	([5])	5	[2]2
Zircon ___ do.	3	20	([5])	5	[2]3
Zoisite (tanzanite) ___ do.	10	([5])	11	10	[2]2
Unspecified ___ do.	33	55	21	--	[2]9
Gypsum and anhydrite, crude	[e]8,000	8,255	20,206	9,430	11,300
Lime, hydrated, and quicklime	[e]2,000	[e]2,000	5,128	6,111	6,500
Mica, sheet	7	7	6	6	10
Salt, all types	46,441	27,991	29,352	37,078	[2]17,111
Stone, sand and gravel:					
Calcite	3	2	NA	NA	NA
Ornamental stone:					
Art stone	25	16	5	10	[2 4]5
Amethystine quartz ___ kilograms	3	2	4	NA	NA
Glass sand	28,000	28,000	28,000	[e]30,000	30,000
Vermiculite[e]	20	20	20	20	20
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous	3,000	3,000	3,500	900	1,000
Petroleum refinery products:					
Gasoline ___ thousand 42-gallon barrels	[e]989	895	794	781	780
Kerosine ___ do.	[e]212	349	328	292	300
Jet fuel ___ do.	[e]420	241	173	244	240
Distillate fuel oil ___ do.	[e]2,585	1,170	978	976	1,000
Residual fuel oil ___ do.	[e]2,361	1,847	1,573	1,710	1,700

See footnotes at end of table.

Table 1.—Tanzania: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum refinery products —Continued					
Liquefied petroleum gas thousand 42-gallon barrels	[e]68	72	63	78	80
Refinery fuel and losses do	[e]389	317	310	300	300
Total do	[e]7,024	4,891	4,219	4,381	4,400

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Table includes data available through Nov. 4, 1981.
[2]Reported figure.
[3]Estimates based on reported total diamond output and best available information on the ratio of gem to industrial stones in total output.
[4]Exports.
[5]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Gold.—The reopening of the Buck Reef and Lupa gold mines was projected to produce a total of 25,700 thousand troy ounces per year, at a cost of $88 million. Small-scale operations commenced at the Lupa mines in the Mbeya region, resulting in 322 troy ounces of refined gold exports during 1979. Machinery installation and construction work on the Buck Reef Mine, at Geita within the Mwanza region, was expected to commence early in 1981.

Iron and Steel.—Iron and steel products continued to be produced in small quantities during 1980. Large titaniferous and vanadiferous iron ore deposits, grading 48% Fe, 12.8% TiO_2, and 0.7% V_2O_5, were known to exist in southern Tanzania. Inadequate infrastructure and market constraints hindered their development. The completion of the Uhuru Railway between Zambia and Tanzania improved the potential for domestic development of the known reserves. The National Development Corp. (NDC) was considering extending existing steel rolling mills and galvanizing capacity by establishing a second iron and steel plant. The United Nations Industrial Development Organization (UNIDO) was assisting NDC in planning the $1.2 billion facility. The plant is to be located in the southwestern Njombe district and would utilize domestic iron ore and coal reserves. Plant capacity was projected to be capable of producing 10,000 tons of iron and 300,000 tons of steel annually.

NONMETALS

Cement.—Tanzania's Saruji Corp. nearly doubled the Nation's annual cement capacity to approximately 1.1 million tons during 1980. The new Tanga plant, rated at 1,600 tons per day, consisted of a kiln with a four-stage cyclone preheater and Unax planetary cooler, a raw mill, and a finish mill. Another 800-ton-per-day plant was under construction at Mbeya and was expected to come online in 1981. The equipment contract for the Mbeya plant was awarded to the same company that supplied the equipment for the Tanga Plant, F.L. Smidth (Denmark). Saruji Corp. planned to upgrade the country's first cement facility located at Wazo Hills. Another 800-ton-per-day dry-process plant was to be installed, with Kulijan Corp. handling the engineering design and initial commissioning of the facility. Feasibility studies were under way for two more cement plants which were projected to add 2,100 tons per day to capacity.

Diamond.—Diamond output increased in 1979 due to greater recoveries from the Mwadui and New Almasi Mines. Approximately 314,000 carats were produced at the two kimberlite mines in 1979, registering an 11.3% increase over 1978 levels. Diamond continued to be the most important mineral foreign exchange earner during 1980, despite depressed world market conditions. Roughly $12.5 million in foreign exchange earnings were attributed to Tanzania's diamond industry in 1980.

Fertilizer Materials.—*Phosphate.*—Plans were under way to develop the Minjingu phosphate deposit in the Arusha region of Tanzania. The deposit was discovered 20 years ago and was estimated to contain 10 million tons of phosphate. STAMICO was negotiating technical and financial assistance for the construction of the $180 million mine and processing plant. Approxi-

mately 170,000 tons of phosphate ore per year was expected to be processed into 100,000 tons of phosphate concentrate by 1983. The phosphate was expected to replace Middle East phosphate imports, which were used at the Tanzania Fertiliser Co. (TFC) plant in Tanga. Reserves at the Minjingu deposits were expected to last for more than 15 years and save about $8.5 million per year in foreign exchange.

Nitrogenous.—Toward the end of 1980, an Agrico subsidiary, Agrico Overseas Investment Corp. (U.S.), provisionally agreed to form a joint venture called Kilwa Ammonia Co. with Tanzania. Plans to construct a large-scale fertilizer complex at Kilwa Maseko were discussed. The proposed 345,000-ton-per-year plant was projected to cost $450 million. The expected products, ammonia and urea, were projected to exceed domestic requirements; therefore, the majority of the urea produced was to be exported. Natural gas from Tanzania's offshore gasfields were expected to be used as plant feedstock, and operations were expected to commence during 1984.

Mica.—Small-scale mining of mica continued at Morogoro, the Pare Mountain area, and within the Karagwe district. Although mica output declined by 3.5% in 1979, rising prices in the world market continued to compensate for production losses projected through 1980. U.S. trade data indicated that imports of Tanzanian unmanufactured mica increased by 25% to 705.5 kilograms between 1979 and 1980.

Mica was Tanzania's only industrial mineral mined in sufficient quantities for export during 1980. Part of the work program, outlined by ESAMRDC in 1980, included evaluating the uses and specifications of Tanzania's available industrial raw materials. The investigations were to assess mica, graphite, magnesite, bentonite, kaolin, and soda ash development potentials. In addition, ESAMRDC was planning to organize and advise small-scale cooperative mining societies for mica, gem stones, gold, and gypsum.

MINERAL FUELS

Coal.—Plans were made to develop large-scale mining at the Songwe-Kiwira coal deposits in southwest Tanzania. Proven reserves of bituminous coal were estimated at 300 million tons. The Tanzanian Government was encouraging joint venture participation schemes to generate investment capital and technical assistance. In the near term, the focus was expected to be on expanding production at known deposits. High transportation costs and the lack of adequate local markets have prevented large-scale development of the existing coal deposits. These constraints were expected to become less significant as the iron and steel and infrastructure projects in southern Tanzania were completed.

Natural Gas.—Huge natural gas deposits were discovered in 1978, offshore southern Tanzania's Songo Songo Islands. Two test wells drilled during 1979 revealed approximately 100 billion cubic feet of proven gas reserves. Two more wells, on and offshore, were drilled by TPDC in 1980. The last well showed traces of light crude, which encouraged further exploration. The International Development Agency of the World Bank provided, for the first time, direct funding, worth $30 million for drilling operations.

Petroleum.—The completion of seismographic surveys have confirmed "reasonable petroleum prospects" in Ruri, Kimbiji and Mafia (Coast region), Bigwa (Morogow region), and certain parts of the Zanzibar Channel.[5] Numerous international oil companies were interested in obtaining exploration rights, despite the fact that no commercial quantities of oil were found by yearend 1980. Algeria's SONATRACH signed a new agreement with TPDC in September 1980. A previously signed technical cooperation accord was expanded to include exploration and pilot drilling.

At least one exploratory well was expected to be drilled in the northern part of the Songo Songo Field. Algeria was expected to supply the oil experts and drilling equipment. In addition, if oil is found the drilling operation will be carried out by Algeria in accordance with Tanzania's new petroleum law.

Tanzania's major oil supplier, Iraq, was expected to continue to provide financial and technical assistance for various energy-related projects. Iraq was considering financing the major portion of the expansion of Tanzania's refinery capacity. The proposed $256 million plan would raise the Dar es Salaam refinery capacity from 17,000 barrels per day to approximately 36,250 barrels per day. A feasibility study for the project was completed in August 1980.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Tanzanian shillings (TSh) to U.S. dollars at the rate of TSh8.1818=US$1.00.

[3]Estimated percentages include nonfuel minerals only.

[4]Langellier, J. P. Socialism in Outline Form. Le Monde (Paris), Oct. 23, 1980, p. 8.

[5]Daily Nation (Kenya). Oil Firms Seek Exploration Rights. July 24, 1980, p. 9.

The Mineral Industry of Thailand

By Gordon L. Kinney[1]

The Thai economy continued a moderate uptrend during the early part of 1980, but strong inflationary pressure and a growing balance of trade deficit were powerful restraints on the national economy. Real growth in gross national product (GNP) was 5.8% in 1979 and 5.5% in 1980, and the agricultural sector expanded perhaps by 10% in the 1980 crop year.

GNP for 1979 was $26.8 billion[2] in current prices and $13.2 billion at constant 1972 prices. The 1980 GNP estimate was $32.3 billion, or $13.9 billion in 1972 prices.[3]

The cost of living index increased by 15% during 1979. As Thai inflation rates have been relatively low among the less developed countries, this unprecedented increase caused problems in the economy. Businesses seeking to maintain their profit margins were partly responsible for a cost-push inflationary spiral that climbed to an estimated 20% per annum rate in 1980.[4] The Government sought ways to lessen the cost of living increase on the lower income workers, in part by not passing on increased utility and transport costs to the public, and also by tightening price controls on certain basic products. The result of these policies has been spreading shortages of sugar, milk, cement, steel rods, and other consumer items, and the emergence of a black market in retail trade.

The farming sector employed about 70% of the labor force in Thailand. However, the relative importance of agriculture to the economy has gradually decreased from 34% of gross domestic product (GDP) in 1973 to less than 26% in 1979. Mining and quarrying on the other hand have continued a slow increase in relative importance from 1.3% of GDP in 1975 to 2.4% in 1979.

Much of the Thai mining industry was highly labor intensive and frequently showed large changes in the number of persons employed. In addition, some sectors show strong seasonal employment as well. The overall mining work force dropped from 84,000 in December 1978 to 68,000 in December 1979. By mid-1980, the total was 54,000, a small decline from the same period of 1979. In November 1980, the labor force had returned to 73,000 reflecting the return of the seasonal tin workers. The tin and combined tin-tungsten operators employed over 60,000 people or 83% of all Thai miners in November 1980. This was an increase from 76% in November 1979.

In June 1980, the Thai cabinet issued new regulations directed toward the offshore tin mining industry. Foreign companies that had operated in Thailand for 25 years and that wanted to be given a new concession to the same area must form a new company in which Thai citizens hold at least 70% of all shares. Foreign countries requesting concessions in new areas must have 51% of the shares held by Thais. Five years from start of operations, the shares must be distributed so that Thais have at least 70% ownership. Foreign companies that have registered as Thai companies and had binding offshore mining contracts prior to June 1980 can continue under the old 60-40 proportion.

The new regulations concern operations in water less than 61 meters deep. In deeper water, which requires high-level technology, companies will continue as before except that the Government mining company and Thai citizens must also be allowed to invest. Sixty percent of the shares must be owned by Thais within 10 years of the start of operation. The Government was determined that as much of the mining profits as possible should stay in the country without jeopardizing future foreign investment.

In other mining developments, the Offshore Mining Organization (OMO) took delivery of its new 16-cubic-foot bucket-ladder dredge *Bodan* built in Singapore. This will be OMO's first attempt at operating a tin dredge on its own rather than leasing or contracting the operation to private companies.

The Thai Pioneer Enterprise Co. tin smelter at Pathum Thani was being completed at yearend. The 3,600-ton-per-year plant was Thailand's second tin smelter. The Board of Investment (BOI) granted promotional privileges for the country's first tantalum refinery. The plant would use tantalum-columbium-rich tin smelter slags, which are currently exported.

Possibly of more economic significance to the country than any other mineral development during 1980 was the start of construction on the offshore natural gas pipeline. The pipeline will be a major factor in stabilizing the rapidly rising fuel import costs by substituting domestic gas for most of the imported fuel oil.

The electric power situation in the first half of 1980 was critical as the water level in reservoirs became so low after the drought that hydroelectric power production was barely possible. In addition, the need for irrigation water for the second rice crop and the desire to conserve high-price fuel oil used in thermal power generation prompted the Government to introduce various measures to cut down electric consumption.

Output from mostly oil-fired steam turbine generators increased by 33% and accounted for 84% of total output in the first half of 1980. Hydropower production dropped sharply from a total of 1,473 million kilowatt hours in the first half of 1979 to 587 million kilowatt hours in the same period of 1980. Hydropower normally accounts for 25% of total electricity generation but dropped to only 9.4% because of the water shortage.

As the cost of fuel oil increased, the deficit between the heavily subsidized price of electricity and the actual cost of generating it grew to an unmanageable level. As a result, the Government increased the price of electricity to the consumer by an average of 38% in February 1980. Even with the price increase, the Government subsidy was still substantial.

PRODUCTION

Tin mining in Thailand is a significant local industry and supplies about 13% of the total world output. Tin metal production capacity is around 33,000 tons per year; all production is virtually by the Thaisarco smelter. In addition, significant amounts of columbium and tantalum are recovered and shipped in the form of slag from the tin smelting operations. Other valued byproducts of Thailand's tin mining sector include ilmenite, monazite, xenotime, and zircon. Close to 3,000 tons of elemental antimony contained in ore and about 1,600 tons of tungsten in concentrates are produced annually. Minor quantities of iron ore, lead, and manganese are also mined locally.

Thailand's mine output of fluorspar—both acid and metallurgical grades—are solely for export. In addition to other aggregates and gypsum, dolomite and limestone are quarried and consumed principally by the cement industry. Output of other nonmetallics of significance to the local economy included asbestos, china clay, feldspar, talc, and pyrophyllite.

Domestic production of crude petroleum is negligible, and all of Thailand's refinery output is essentially derived from imported crude. As a result of the high price of energy, use of indigenous resources of lignite have increased. Lignite production has increased from 0.4 million tons in 1977 to around 1.4 million tons in 1980. Likewise, development and use of offshore natural gas was expected to increase rapidly after 1980.

The mineral industry as a whole contributed $676 million to the Thai economy in 1979, or about 2.4% of GNP.

Table 1.—Thailand: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Antimony:					
Ore and concentrate:					
Gross weight	8,637	5,774	6,759	6,905	6,862
Metal content	3,671	2,454	2,873	2,935	2,916
Metal, smelter	470	159	35	101	21
Chromium: Chromite, gross weight	--	r490	65	42	--
Columbium and tantalum ores and concentrates, gross weight:[2]					
Columbite	--	33	64	382	213
Tantalite	7	41	--	25	143
Mixed columbite-tantalite	NA	NA	NA	231	301
Iron and steel:					
Iron ore (55% Fe), gross weight	25,000	63,470	88,121	103,101	84,966
Metal:					
Pig iron	r11,530	r19,333	20,812	30,224	17,738
Ferroalloys:					
Ferrosilicon	1,159	--	1,635	1,500	60
Ferromanganese	1,509	706	747	750	112
Steel, primary forms:					
Ingots	162,840	300,000	314,132	270,000	183,130
Billets	112,276		17,017	20,000	245,304
Semimanufactures (selected):					
Bars	93,210	NA	NA	NA	321,517
Galvanized iron sheets	88,894	101,687	84,808	85,000	129,342
Tinned plates	26,215	36,118	43,939	40,000	69,852
Lead:					
Mine output, metal content of 42.5% Pb concentrate	904	506	1,663	8,719	10,560
Metal: Ingot, unwrought, secondary	825	1,181	1,101	765	e1,200
Manganese ore:					
Chemical grade, over 75% MnO_2	130	63	78	42	11
Battery grade and chemical grade, 75% MnO_2	3,230	4,762	6,635	5,828	2,716
Metallurgical grade, 46%-50% MnO_2	46,865	72,137	65,498	29,496	51,583
Total	50,225	76,962	72,211	35,366	54,310
Rare-earth metals:					
Monazite concentrate, gross weight	--	--	3767	32	152
Xenotime	--	50	--	6	52
Tin:					
Mine output, metal content	20,452	24,205	30,186	33,962	33,685
Metal, smelter, primary	20,337	23,102	28,945	33,058	34,689
Titanium: Ilmenite concentrate, gross weight	200	--	482	780	--
Tungsten concentrate:					
Gross weight	3,986	4,276	6,182	3,543	3,134
Metal content	2,050	2,204	3,187	1,826	1,615
Zinc, smelter production	71	31	8	10	30
Zirconium ore and concentrate, gross weight	55	r303	25	116	61
NONMETALS					
Asbestos	15	4	--	--	--
Barite	151,343	118,466	274,564	378,654	305,057
Cement, hydraulic thousand tons	4,460	r5,110	5,091	5,255	e5,300
Clays:					
Ball clay	3,274	720	--	1,766	1,557
Kaolin	16,660	r24,810	33,764	42,769	19,934
Kaolinite (dickite)	r3,340	1,160	930	1,320	5,020
Diatomite	--	190	1,105	3,418	1,982
Feldspar	12,257	17,619	32,583	26,428	24,158
Fluorspar:					
Crude mine output:					
High grade	128,529	193,315	175,531	177,730	172,784
Low grade	71,835	46,490	84,255	82,122	133,547
Total	200,364	239,805	259,786	259,852	306,331
Salable product:					
Acid grade (beneficiated low grade)	53,322	54,826	55,000	r e53,600	e87,200
Metallurgical grade	128,529	193,315	175,531	177,730	172,784
Total	181,851	248,141	230,531	231,330	259,984
Graphite	30	23	23	--	2,074
Gypsum	267,822	380,090	280,904	352,398	411,977
Nitrogen, N content of ammonia	7,000	7,000	9,000	--	--
Phosphate rock, crude	7,250	3,100	3,485	4,542	5,570

See footnotes at end of table.

Table 1.—Thailand: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Salt:					
Rock	5,575	12,750	11,839	11,000	16,744
Other[e]	165,000	165,000	165,000	165,000	165,000
Sand, silica	24,145	112,168	170,227	157,076	171,000
Stone:					
Calcite	590	75	1,182	1,860	360
Dolomite	30	3,370	4,400	4,030	8,130
Limestone for cement manufacture only thousand tons	493	706	2,631	2,964	3,958
Marble	--	--	--	4,896	5,649
Marl for cement manufacture only thousand tons	435	585	1,460	2,262	1,939
Quartz, not further described	31,563	34,520	22,220	22,240	7,828
Shale for cement manufacture only	74,504	180,696	484,518	748,499	800,682
Talc and related materials:					
Pyrophyllite	5,787	9,851	12,190	11,191	10,350
Talc	[r]670	517	2,698	2,351	1,376
MINERAL FUELS AND RELATED MATERIALS					
Coal: Lignite thousand tons	680	[r]436	639	1,356	1,427
Petroleum:					
Crude thousand 42-gallon barrels	57	103	107	109	[e]110
Refinery products:					
Gasoline do.	9,332	13,317	12,965	14,535	[e]14,700
Jet fuel do.	7,673	4,732	4,750	5,720	[e]5,800
Kerosine do.	976	1,761	1,643	1,860	[e]1,900
Distillate fuel oil do.	15,835	17,591	16,200	16,860	[e]17,200
Residual fuel oil do.	17,748	17,787	19,673	19,980	[e]20,300
Other:					
Liquefied petroleum gas do.	2,590	1,508	1,374	1,450	[e]1,500
Naphtha do.	1,811	2,317	1,955	1,920	[e]2,000
Asphalt do.	783	988	954	1,121	[e]1,200
Unspecified do.	11,370	--	223	[r e]250	[e]300
Refinery fuel and losses do.	389	[r]750	1,692	[r e]1,800	[e]2,100
Total do.	68,507	60,751	61,429	65,496	[e]67,000

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through July 30, 1981.

[2]Excludes columbium- and tantalum-bearing tin slags, which make Thailand the world's largest source of newly mined tantalum.

[3]Exports.

TRADE

Thailand exported minerals and metals worth over $735 million in 1980, a 28% increase over 1979. Tin accounted for $550 million or about 75% of the total. Other major mineral exports were tungsten, gem stones, barite, fluorite, antimony, tantalum-bearing tin slag, and lead concentrate. The value of lead concentrate exports continued to rise, but at a slower rate, as the new processing facility was brought up to near its design capacity. Cement continued the swing from a major export item to a significant import commodity. Value of cement imports totaled over $58 million in the first 9 months of 1980. Minerals ranked as one of the four most valuable exports with rice, tapioca products, and natural rubber. The export of tin slag constitutes the major source of new tantalum on the world market.

The value of total trade was $12.5 billion in 1979 and climbed to $15.8 billion for 1980. Exports rose from $5.3 billion in 1979 to $6.5 billion in 1980.[5] The export target for 1981 was placed at $8.4 billion. Imports have been rising at an even faster rate than the exports. The trade gap widened during 1980 when total imports climbed to $9.8 billion. The resulting deficit of over $2.8 billion was the largest ever experienced by Thailand. Petroleum and petroleum products were again the high-cost import items. Compared with 22% of the total 1979 import bill, petroleum accounted for 31% of the total imports in 1980, as the price of crude oil increased 74% over the 1979 price.

Japan was the major trading partner for both exports and imports, but its share of Thailand's total imports dropped from 31% in 1978 to 26% in 1979 and continued the

relative decline to 22% in early 1980.[6] The United States, the Netherlands, and Singapore were the other major importers of Thai goods, while the United States, Saudi Arabia, and the Federal Republic of Germany were major suppliers of Thailand's imports in 1980. Thailand's major imports after fuels were machinery, manufactured goods, and chemicals.

Table 2.—Thailand: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	300	262	--	Singapore 160; Hong Kong 101.
Semimanufactures	1,450	1,393	--	Singapore 348; Malaysia 300; Hong Kong 293; Japan 191.
Antimony:				
Ore and concentrate	5,594	5,689	782	Belgium 2,619; West Germany 1,132; France 390.
Metal including alloys, unwrought	73	60	--	Netherlands 40; Japan 10; Taiwan 10.
Chromium: Chromite	--	62	--	All to Malaysia.
Columbium ore and concentrate	310	332	7	Netherlands 225; West Germany 50; Singapore 40.
Copper metal including alloys, all forms	27	7	--	Jordan 3; Singapore 2; Laos 1.
Iron and steel metal:				
Pig iron, ferroalloys, similar materials	20	--		
Semimanufactures	30,966	44,122	32	Hong Kong 11,870; China, mainland 11,649; Singapore 6,209.
Lead:				
Ore and concentrate	2,500	16,796	--	Netherlands 9,855; Belgium 4,941.
Metal including alloys, all forms	1	91	--	Singapore 60; Hong Kong 30.
Manganese:				
Ore and concentrate	37,941	35,718	--	Japan 31,698; Taiwan 3,120; Hong Kong 900.
Dioxide, synthetic	31	20	--	All to West Germany.
Silver metal including alloys, all forms thousand troy ounces	369	3,638	--	Switzerland 3,162; Hong Kong 379.
Tantalum ore and concentrate	47	1,154	911	Netherlands 199; West Germany 33.
Tin metal including alloys, unwrought	r30,351	31,348	10,837	Netherlands 14,643; Japan 5,828; Hong Kong 40.
Titanium oxide kilograms	125	--		
Tungsten ore and concentrate	5,800	3,609	1,071	West Germany 885; Netherlands 690; Singapore 241.
Zinc:				
Ore and concentrate	--	5	--	All to Belgium.
Oxide	52	130	--	Philippines 57; Pakistan 45; Japan 18.
Metal including alloys, semimanufactures	32	234	--	Laos 231; Burma 2.
Other ores and concentrates	80	289	--	Japan 200; Netherlands 68; West Germany 20.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, corundum, etc	--	20	--	All to Taiwan.
Grinding and polishing wheels and stones	86	7	(1)	Laos 5.
Barite	195,122	288,852	89,600	Indonesia 76,545; Singapore 49,786; Brunei 15,250.
Cement	22,607	22,086	--	Singapore 21,278.
Chalk	2	38	--	All to Laos.
Clays and clay products:				
Crude:				
Fuller's earth, dinas, chamotte	717	1,290	--	Taiwan 1,272; Malaysia 12.
Kaolin	247	550	--	All to Taiwan.
Products:				
Refractory	1,693	1,811	(1)	Malaysia 1,060; Indonesia 472.
Nonrefractory	29,924	22,156	71	West Germany 11,860; Netherlands 2,809.
Diamond:				
Gem, not set or strung carats	6,934	4,302	429	Japan 2,773; Switzerland 420.
Industrial do	1,500	33	33	
Feldspar, leucite, nepheline syenite	413	2,304	--	Japan 2,000; Malaysia 200.

See footnotes at end of table.

Table 2.—Thailand: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude and manufactured, mixed	--	60	--	All to Malaysia.
Ammonia ---------- kilograms	--	27	--	All to Laos.
Fluorspar	205,697	219,390	--	Japan 122,395; United Kingdom 47.
Gypsum and plasters	83,532	89,960	--	Malaysia 78,949; Indonesia 10,200; Singapore 706.
Precious and semiprecious stones, except diamond:				
Natural:				
Precious --- thousand carats	19,528	17,392	3,042	Hong Kong 4,719; West Germany 2,838; Switzerland 1,434.
Semiprecious ---- kilograms	49,905	98,129	351	Hong Kong 86,724; Australia 599.
Manufactured ---------- do	73	57	7	Singapore 22; Lebanon 21.
Salt	92,943	113,274	--	Malaysia 71,520; Singapore 30,358; Laos 4,402.
Sodium and potassium compounds, n.e.s	6	216	--	Singapore 200; Malaysia 10.
Stone, sand and gravel:				
Gravel and crushed rock	5	(1)	--	All to Laos.
Limestone	14	8	--	Laos 7.
Quartz and quartzite	17,716	26,949	--	All to Japan.
Sulfur, colloidal	340	192	--	Sri Lanka 110; Singapore 80.
Other: Slag, dross, and similar waste, not metal-bearing	10,080	5,554	2,735	Taiwan 851; Japan 831; Netherlands 748.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	790	282	--	Indonesia 280; Singapore 2.
Carbon black	5	2	--	Japan 1.
Coal, all grades, including briquets	53	1,176	--	Malaysia 630; Taiwan 220; Pakistan 118.
Petroleum refinery products:				
Gasoline, motor and aviation thousand 42-gallon barrels	--	30	--	Mainly to Singapore.
Jet fuel ---------- do	221	445	2	India 99; Hong Kong 50; Saudi Arabia 44; Pakistan 41.
Lubricants ---------- do	1	1	NA	NA.
Mineral jelly and wax ---- do	(1)	--		
Other:				
Liquefied petroleum gas do	(1)	(1)	--	All to Malaysia.
Petroleum coke ---- do	--	1	--	All to Singapore.
Unspecified ---- do	21	9	--	Singapore 8.

rRevised. NA Not available.
1Less than 1/2 unit.

Table 3.—Thailand: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	5,911	10,192	3,271	Malaysia 5,621; China, mainland 1,300.
Oxide and hydroxide	3,981	8,868	284	China, mainland 6,850; Japan 1,585.
Metal including alloys:				
Scrap	1,456	1,142	(1)	Yugoslavia 497; Australia 366; Laos 243.
Unwrought	34,019	43,206	1,886	Canada 13,627; Bahrain 6,100; Japan 3,952; Ghana 2,687.
Semimanufactures	4,935	4,960	686	Japan 1,262; Australia 408; France 386; Sweden 313.
Antimony:				
Ore and concentrate	--	9	--	All from Burma.
Metal including alloys, all forms kilograms	5	4,005	--	China, mainland 4,000; United Kingdom 5.

See footnotes at end of table.

Table 3.—Thailand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Arsenic trioxide, pentoxide, acids	58	152	--	China, mainland 78; France 39; Belgium 20.
Cadmium metal including alloys, all forms kilograms	513	995	--	Australia 970; United Kingdom 25.
Chromium:				
Chromite	--	100	--	All from United Kingdom.
Oxide and hydroxide	373	385	(1)	West Germany 240; U.S.S.R. 133.
Cobalt:				
Oxide and hydroxide	11	13	--	Australia 6; Belgium 3.
Metal including alloys, all forms kilograms	30	--		
Copper:				
Matte	10	--		
Sulfate	373	266	200	West Germany 25; Singapore 20; United Kingdom 11.
Metal including alloys:				
Scrap	672	511	235	Laos 157; Botswana 119.
Unwrought:				
Blister copper and other unrefined copper	439	802	--	Zambia 602; Belgium 174.
Refined, unalloyed	4,978	5,379	9	Zambia 2,910; Belgium 1,350; Japan 583.
Semimanufactures	11,363	12,533	2,317	Japan 6,629; Taiwan 1,191; Chile 1,039.
Master alloys	66	206	192	United Kingdom 9.
Gold metal, unworked or partly worked troy ounces	230,874	108,370	18,794	West Germany 77,435; Switzerland 10,969.
Iron and steel:				
Ore and concentrate	471	11	--	Mainly from Malaysia.
Metal:				
Scrap	801,963	614,808	275,616	Hong Kong 68,335; West Germany 56,404; Italy 44,182.
Pig iron, ferroalloys, similar materials	4,730	29,016	10	Sweden 22,412; Taiwan 3,668.
Sponge iron, powder, shot	502	683	114	Japan 403.
Steel, primary forms	79	87	(1)	Spain 37; United Kingdom 20; Japan 15.
Semimanufactures thousand tons	1,109	1,255	63	Japan 821; Republic of Korea 69; Mozambique 30.
Lead:				
Oxide	478	322	(1)	Australia 254; China, mainland 45.
Metal including alloys:				
Scrap	208	30	--	Mainly from Singapore.
Unwrought	9,460	10,837	44	Australia 8,989; Denmark 602; Taiwan 557.
Semimanufactures	204	141	(1)	West Germany 78; Australia 25.
Magnesium:				
Oxide	31	41	2	Japan 28; China, mainland 10.
Metal including alloys:				
Unwrought	5	13	8	Japan 4.
Semimanufactures kilograms	393	710	--	Switzerland 500; United Kingdom 100; West Germany 74.
Manganese:				
Ore and concentrate	1,028	847	--	Singapore 700; Japan 95.
Dioxide, synthetic	1,195	2,220	--	Singapore 1,625; China, mainland 300; Japan 145.
Oxides, other	373	401	(1)	Japan 340.
Mercury 76-pound flasks	169	363	32	Japan 216; Australia 58.
Molybdenum metal including alloys, all forms kilograms	849	885	745	Japan 100; Netherlands 40.
Nickel:				
Matte, speiss, similar materials	4	2	--	All from Australia.
Metal including alloys:				
Scrap	13	--		
Unwrought	15	242	5	Canada 142; Philippines 30.
Semimanufactures	341	680	5	Republic of Korea 350; Japan 158.
Platinum-group metals including alloys, all forms troy ounces	3,022	1,543	64	Hong Kong 1,318.
Silver metal including alloys all forms thousand troy ounces	r3,715	529	30	Burma 160; West Germany 124; Japan 99.
Tin:				
Oxide	2	3	--	Mainly from Japan.
Metal including alloys:				
Unwrought	10	7	--	United Kingdom 3; Denmark 3.
Semimanufactures	12	15	2	Japan 7; United Kingdom 5.

See footnotes at end of table.

Table 3.—Thailand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Titanium:				
Ore and concentrate	618	799	--	Australia 779; Japan 20.
Oxide	1,442	1,458	313	Australia 360; West Germany 194; Belgium 190.
Tungsten metal including alloys, all forms	1	3	(1)	Japan 2.
Zinc:				
Oxide	365	245	1	Japan 142; West Germany 37; Australia 20.
Metal including alloys:				
Scrap	161	337	36	Australia 301.
Powder and dust	43	46	(1)	Singapore 19; Norway 17; Australia 8.
Unwrought	33,455	33,822	50	Australia 23,960; Canada 4,724; Japan 2,488.
Semimanufactures	178	274	(1)	United Kingdom 142; Yugoslavia 92.
Zirconium ore and concentrate	50	3	--	All from Japan.
Other:				
Ores and concentrates of base metals, n.e.s	16,920	9,483	--	Malaysia 5,411; India 3,000; Singapore 360.
Metals:				
Alkali, alkaline-earth, rare-earth metals kilograms	323	40	2	United Kingdom 37.
Pyrophoric alloys	63	86	3	China, mainland 68; West Germany 7.
Base metals including alloys, all forms	41	20	6	China, mainland 10.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, corundum, etc	2,562	2,285	127	Netherlands 1,086; India 720; Japan 137.
Dust and powder of precious and semi-precious stones kilograms	14	34	21	Belgium 5.
Grinding and polishing wheels and stones	1,931	2,246	6	Japan 795; Taiwan 651; India 67.
Asbestos	50,690	72,528	2,523	Botswana 21,318; Canada 17,986; Australia 14,469.
Barite and witherite	60	31	--	West Germany 25; United Kingdom 5; Japan 1.
Bromine:				
Elemental kilograms	39	33	1	West Germany 26; United Kingdom 5; Japan 1.
Compounds	47	102	6	United Kingdom 33; Japan 18; China, mainland 17.
Cement thousand tons	352	1,237	(1)	Republic of Korea 412; Indonesia 263; Malaysia 195.
Chalk	1,118	1,018	--	France 998; United Kingdom 20.
Clays and clay products:				
Crude:				
Bentonite	2,163	2,141	1,154	China, mainland 850; Japan 55.
Fire clay	40	60	--	Japan 40; Taiwan 20.
Fuller's earth, dinas, chamotte	13,687	9,557	1,447	Switzerland 4,006; Japan 1,856; Australia 971.
Kaolin	2,296	3,452	853	Japan 1,155; China, mainland 400.
Kyanite and sillimanite	4	10	--	All from Japan.
Other	783	616	36	United Kingdom 540; China, mainland 40.
Products:				
Refractory including nonclay bricks	6,054	9,646	1,753	West Germany 2,738; Japan 2,736.
Nonrefractory	605	9	(1)	Japan 5; West Germany 3.
Diamond:				
Gem, not set or strung carats	14,093	5,845	--	Belgium 2,959; Republic of South Africa 2,465.
Industrial do	69,767	133,774	--	Netherlands 50,750; Zaire 23,770; Ireland 21,000.
Diatomite and other infusorial earth	37	35	35	
Feldspar, leucite, nepheline syenite	1,263	740	--	India 370; Finland 141; Japan 58.
Fertilizer materials:				
Crude and manufactured:				
Nitrogenous	229,329	189,387	4,694	West Germany 70,233; Japan 49,670; Belgium 38,985.
Phosphatic	4,670	11,650	(1)	West Germany 10,000; Japan 1,000.
Potassic	22,752	35,997	--	West Germany 11,621; East Germany 10,575.
Other including mixed	500,279	624,343	214,417	Romania 131,664; Japan 88,549; Norway 49,176.

See footnotes at end of table.

Table 3.—Thailand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Ammonia	306	1,832	2	Japan 974; Indonesia 399; Malaysia 236.
Fluorspar	752	1,586	--	India 997; Japan 262; Finland 245.
Graphite, natural	1,494	1,519	6	Australia 864; China, mainland 240; Sri Lanka 200.
Gypsum, anhydrite, plasters	294	555	--	Japan 240; West Germany 170; China, mainland 145.
Iodine kilograms	1,488	1,324	3	West Germany 652; Japan 600.
Lime	200	285	--	All from United Kingdom.
Magnesite	7,164	7,276	--	Japan 4,077; China, mainland 2,150; United Kingdom 643.
Mica	119	131	13	India 78; Japan 21.
Pigments, mineral, including processed iron oxides	1,892	2,215	25	West Germany 1,318; Japan 346; United Kingdom 210.
Precious and semiprecious stones, except diamonds:				
Natural:				
Precious thousand carats	158,795	197,382	4,757	Australia 120,570; Brazil 33,875; Mozambique 11,186.
Semiprecious kilograms	177,510	171,196	8	Burma 164,231; Australia 3,996.
Manufactured do	2,737	5,714	668	France 1,781; Brazil 1,500; Switzerland 1,352.
Salt	274	332	23	Australia 125; United Kingdom 120.
Sodium and potassium compounds, n.e.s	14,244	35,861	194	Japan 15,422; Taiwan 8,323; Poland 3,719; United Kingdom 2,924.
Stone, sand and gravel:				
Dimension stone:				
Crude:				
Calcareous (marble)	163	14	--	Belgium 13.
Slate	100	--		
Other	466	197	--	Mainly from China, mainland.
Worked:				
Calcareous (marble)	867	775	--	Do.
Slate	87	337	--	China, mainland 193; Italy 117.
Paving and flagstone	(1)	--		
Other	248	235	--	China, mainland 220, Japan 14.
Dolomite, chiefly refractory grade	60	60	--	All from Taiwan.
Gravel and crushed rock	1,095	1,002	--	France 865; China, mainland 60.
Quartz and quartzite	376	416	--	Hong Kong 296; Japan 114.
Sand, excluding metal-bearing	460	698	44	Norway 350; Belgium 230.
Sulfur:				
Elemental:				
Other than collidal	43,400	27,063	5,172	Canada 20,676.
Colloidal	148	643	118	Singapore 300; Japan 91; Taiwan 90.
Sulfur dioxide	1	14	--	Japan 11; Australia 2.
Sulfuric acid	35	2,101	20	Japan 2,006.
Talc and steatite	15,100	15,582	61	China, mainland 8,204; Republic of Korea 6,900.
Other:				
Crude	1,010	774	(1)	China, mainland 420; West Germany 300; Japan 46.
Slag, dross, and similar waste, not metal bearing	1	21	--	All from Japan.
Oxides and hydroxides of strontium and barium	51	1,572	41	Japan 1,526.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	52	--		
Carbon black	15,783	17,289	48	Australia 11,167; Japan 1,132.
Coal, all grades, including briquets	13,094	20,270	NA	Indonesia 12,397; Vietnam 7,695.
Coke and semicoke	34,964	43,080	--	Japan 41,030; Burma 1,480.
Petroleum:				
Crude and partly refined:				
Crude thousand 42-gallon barrels	56,621	62,727	--	Saudi Arabia 25,267; Qatar 17,201; China, mainland 5,702.
Partly refined do	4,582	1,637	--	Saudi Arabia 1,450.
Refinery products:				
Gasoline:				
Aviation do	162	87	--	Taiwan 64; Iran 17.
Motor do	1,618	1,226	--	Singapore 1,019; Bahrain 105; Taiwan 102.

See footnotes at end of table.

Table 3.—Thailand: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Kerosine				
thousand 42-gallon barrels	65	80	--	Singapore 79.
Jet fuel ---------- do	307	609	(1)	Singapore 456; Bahrain 152.
Distillate fuel oil ----- do	14,730	10,108	--	Singapore 6,488; China, mainland 2,498.
Lubricants ---------- do	866	1,028	74	Singapore 644; Australia 175; Netherlands 47.
Other:				
Liquefied petroleum gas do	418	550	--	Singapore 499; Indonesia 35.
Mineral jelly and wax do	82	98	4	China, mainland 44; Indonesia 26; Japan 10.
Nonlubricating oils, n.e.s. do	166	151	3	Singapore 102; Australia 35.
Bitumen and other residues do	14	16	(1)	Singapore 13.
Bituminous mixtures, n.e.s. do	2	6	1	United Kingdom 2; Malaysia 2.
Pitch, pitch coke, petroleum coke ---------- do	39	68	32	Burma 22; Taiwan 12.
Total ------- do	18,469	14,027		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals -----	1,272	20,630	18,972	Japan 878.

[r]Revised. NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Iron and Steel.—Plans for a natural-gas fueled direct-reduction plant and electric furnace steel mill were being discussed during the year but no firm decisions were made. Projected location of the plant would be on the Gulf of Thailand near Rayong. Thailand has small, rather low-grade iron ore deposits and unless future exploration confirms more suitable iron ore, the proposed plant would have to use a blend of imported and domestic ores. Thai scrap supplies were expensive and unreliable. The direct-reduction plant would insure dependable supplies of sponge iron that could be substituted for scrap in the electric arc furnaces.

Thailand's raw steel capacity was about 570,000 tons per year in 1980. Most production comes from scrap-based electric furnace steelmakers, utilizing their own rolling mills. The Siam Iron and Steel Co., Ltd., has a 100,000-ton-per-year blast furnace that uses local raw materials. Current rolling capacity was about 1 million tons per year. Reinforcing bars were in short supply because of increased building activity, and much of the industry's demand for rebar and other semifinished steel was met by imports or rolled from imported billets.

Expansion of domestic rebar production was underway by several of the rolling mills. Capacity of the Siam Iron and Steel Co., Ltd., plant in Saraburi Province, was being increased by 120,000 tons per year with completion scheduled for late 1981. Bangkok Steel Industry Co., Ltd., in Samut Prakan Province, Bangkok Iron and Steel Co., Ltd., and Bangkok Iron and Steel Works, Ltd., planned to raise their capacities by 110,000 tons per year, 60,000 tons per year, and 50,000 tons per year, respectively.

Tantalum and Columbium.—For several years Thailand has been the world's largest supplier of tantalum, mainly in the form of exported tin smelter slags. In 1979-80, Thailand supplied more than one-third of the market economy countries' output.

Rather than continuing the export of slag, the second most valuable mineral export, the Thai Government decided to have the tantalum extracted within the country. As a result, the Thai BOI reportedly awarded the recently formed Thailand Tantalum Industries Co. (TTIC) full promotional privileges for a proposed tantalum refinery project (TTIC is 90% Thai share-

holders, 10% S.A. Minerals Co., Malaysia). BOI ruled that TTIC should have sole rights to produce tantalum pentoxide in Thailand for a period of 8 years. Of critical importance to the TTIC proposal was the additional stipulation by BOI that there will be a ban on all tin slag exports to begin 1 year before TTIC's planned start of operations. If the plant was built, the 100% Billiton Thailand Ltd.-owned Thaisarco tin smelter would apparently have to supply all of its slag to TTIC. Billiton had also submitted a proposal for a tantalum processing facility to BOI but this was reportedly rejected late in 1980.

The TTIC project was to consist of a refinery in Phuket to be built in two phases and completed in 1983. The first phase was a plant to produce 2,000 tons per year of ferrotantalum-columbium alloy. The second phase, at the same site, was to produce 300 tons per year each of tantalum pentoxide and columbium pentoxide. Hermann C. Starck Co. of the Federal Republic of Germany has agreed to furnish process technology for the plant in return for at least one-half of its total output.

The new plant would also be able to process Thai tantalite and columbite concentrates and the much lower grade Malaysian tin smelter slags. In connection with the new project, the Thai Department of Mineral Resources has apparently drawn up new royalty regulations for the tantalum content of the tin slag produced at the Thaisarco smelter. If plans and construction proceed as scheduled, Thailand could be producing 40% of the world's tantalum by yearend 1983 (which includes imported Malaysia slag).[7]

Tin.—As in past years, tin was by all measures Thailand's most valuable mineral commodity and by far the largest employer, both directly and indirectly in the mineral sector. In 1979, more than 80% of the earnings from mineral exports came from tin, and the tin industry contributed 94% of the Thai Government's revenue from mineral royalties.[8]

Despite the increases in production over the last few years, the tin industry was facing some serious problems.

Energy costs more than doubled in the last 2 years, increasing costs at all stages of the mining and refining cycle. A drought at the end of 1979 and continuing into early 1980, cut into the water supply needed for onshore dredging and gravel pump mining operations.

At the beginning of 1980, roughly one-half of Thailand's tin was produced from quasi-illegal operations. These consisted mainly of small suction-dredge boats poaching in areas reserved for the OMO. Realizing the potential loss of revenue if this tin did not enter legal channels, the Government authorized various agents to buy tin from illegal operations and then to pay royalties when it is resold to the Thaisarco smelter. Attempts to stop or control the illegal suction boats have met with little success and have resulted in a great deal of political sensitivity.

At the current production rate, the small suction boats will have degraded or depleted most of the deposits in water up to 20 meters deep by the end of 1983. Conversely, the large dredges will also have worked a great deal of the better grade shallower areas. If new shallow water deposits are not found, it appears that the small boats could be out of business in a few years and Thai tin production would drop substantially.

Another problem was security in some of the most promising areas for new tin exploitation. These were the highlands in Nakkon Si Thammarat (08°N, 100°E) and Surat (Thani, 09°N, 99°E) Provinces where insurgents were powerful enough to deny effective control of mining operations to the Government.

Smuggling had been a serious problem in recent years. Since the Government began buying the illicit tin concentrate, and the Malaysia Government banned purchase of smuggled concentrate, the problem has diminished to a tolerable level. Thai industry experts believed that no more than 2,500 tons were smuggled out of the country in 1979.

Delivery of OMO's new $18 million bucket ladder dredge was delayed in early 1980 by construction problems. OMO finally took delivery late in the summer. The 330,000-cubic-meter-per-month capacity dredge was then leased to Aokham Thai Co., Ltd., to dredge for 4 months in its concession area off Phuket. This furnished a shakedown period for the dredge and also a training period for OMO's mining staff to acquire experience in its operation. After this break-in period, the dredge was to be returned to the OMO concession area at Baan Bor Daan off Phangnga Province.

Southern Kinta Consolidated Ltd. ceased tin dredging at its Takuapa concession in southern Thailand because of losses incurred during its offshore operation. The losses were attributed to a depletion of the reserves in its concession area by illegal suction boat operations. The company decided to limit its loss and was moving the

dredge to Phuket Bay where it will be kept under maintenance. Proposals to modify the dredge to increase throughput and enable it to mine thicker alluvium were being considered.[9]

The Thai Natural Resources Department extended the concession of Tongkah Harbor Tin Co. for 25 years. The concession was renewed after Tongkah Harbor changed its equity structure to conform to new Government regulations. The concession area covers 7,000 acres in the southern Provinces of Phuket and Phangnga.

Plans for a new offshore dredging operation in southern Thailand were being delayed by land-use conflicts. The deposit, with 20,000 tons of tin metal content, was located in Patong Bay and was the last known major shallow water deposit that has not been worked previously by either dredge or small suction boats. Sethasap Mining Co., Ltd. (formerly Sethasap Karn Rae Co., Ltd.), the concession holder, planned to work the deposit with a large bucket ladder dredge but individuals and groups supporting tourism and environmental concerns claim the work would despoil the beauty of the area. The deposit could make a significant contribution to Thailand's tin production at a time when output from other offshore areas was expected to begin declining.[10]

Aokham Tin was to form a new company to explore and evaluate tin-bearing reserves several miles off the Takuapa coast in southern Thailand. The company will have Thai and Malaysian participation in accordance with new Thai regulations. A previous seismic survey and scout borings indicated promising reserves at depths below the normal limits of dredging.

Several small new onshore operations or expansions were applied for or granted by BOI during the year. Siam Mineral Products Co., Ltd., applied for promotional privileges to mine tin and process up to 400 tons of concentrate per year at Tambol Suan Phueng in Ratchaburi Province. Sierra Mining Co., Ltd., had a dry mining system and a jig table ore recovery plant under construction at its property in southern Thailand. The expansion would provide data for development of the main ore body, which could be mined at a rate of over 300 tons per year of concentrate. Thai Watana Mining Co., Ltd., applied for permission to produce 2,000 tons per year of concentrate at Thai Muang (8°30'N, 98°15'E), Phangnga Province. In April 1980, Chinteik Brothers Co., Ltd., began operating a mine and a 240-ton-per-year ore dressing plant at Thai Muang in Phangnga Province. This operation reportedly would also produce byproduct tantalite concentrate. A foreign investor and a local Thai company formed International Tantilite Co., Ltd., to develop and expand a local operation. Capacity was to be 1,500 tons per year of tin concentrate and 50 to 70 tons per year of tantalite concentrate.

The Thai Pioneer Enterprise Co.'s smelter at Pathum Thani was ready for commissioning at yearend 1980. The new facility, Thailand's second tin smelter, will have a startup capacity of 3,600 tons per year and refine concentrates from northern and central Thailand.

The Thai Present Co. smelter was erroneously reported in the press to be under construction at Nakhon Pathom in 1979. Construction actually never began at the site and plans were changed for both capacity and location during 1980. The company now reportedly has plans for a 10,000-ton-per-year operation at Phuket with completion scheduled for 1983.

Tungsten.—The Government has approved a proposal by Siam Tungsten International Corp., Ltd., to build the country's first ammonium paratungstate plant. The 3,000-ton-per-year plant would be located at Ayutthaya near Bangkok and cost over $11 million. The company was owned 60% by local Thai shareholders and 40% by unnamed European and U.S. interests. The Thai Government has been advocating more domestic processing and refining of crude minerals wherever feasible to realize a higher value for its nonrenewable natural resources. Export of the ammonium paratungstate would bring a much higher price than the crude tungsten concentrate.

Wolframite production continued a decline started in 1979, while scheelite production showed a small increase for the third consecutive year. The wolframite decline was attributed to the gradual depletion of the high-grade sections of the Khao Soon Mine, which had supplied up to 75% of Thailand's wolframite output during the last few years.

Zinc.—The proposed 60,000-ton-per-year Mae Sot zinc refinery project in Tak Province had another year of trouble in 1980. Early in the year there was a problem of financing the $120 million to $150 million project as the question of its economic viability was studied once again. Moreover, a question of the availability and price of

electricity in the remote area of the mine and plant was brought up. This critical power problem was apparently worked out later in the year. Just as events began to look promising for the start of construction, press reports stated that the prime contractor and 30% owner of Thai Zinc Co., Ltd., Whashin Industrial Co. of South Korea, was having financial troubles at home and might withdraw from the project. Early in November, Whashin Co. informed the Thai Government that it was indeed withdrawing from the project. As a result, on December 5, 1980, the Thai zinc consortium missed the Government's fifth and final deadline for arranging financing and starting construction on the project. Thai Zinc Co. thereby forfeited its mining leases and authorization to construct the attendant refinery.

The Government wants the refinery built and reportedly was considering putting up the leases and construction permit for competitive bidding. If so, the Thai Zinc Co. shareholders, less Whashin Co., could bid. It was rumored, however, that the old Thai Zinc Co. participants would form a new syndicate with Vielle-Montagne S.A. of Belgium heading up the new company.

NONMETALS

Cement.—The cement industry continued to produce at its maximum sustainable production for the third straight year. Production was not sufficient to meet demand, which continued to increase steadily despite efforts to cut consumption. To meet demand, $58 million worth of cement was imported in the first 9 months of 1980. South Korea supplied more than 55% of the total, followed by Japan, Indonesia, and Malaysia.

The Thai BOI announced it would accept applications for new or expanded cement plants in late 1977. At least 10 companies submitted applications and by mid-1978, 5 applications were granted promotional privileges. Work started on some of the projects during 1978-79, but some were postponed or dropped for various reasons and some new proposals were tentatively approved.

In March 1980, the first of the new facilities was completed by the Siam Cement Co. at its Thung Song plant in Nakhon Si Thammarat Province; capacity of the new section was 410,000 tons per year. A 1.6-million-ton-per-year expansion of Siam Cement Co.'s Tha Luang plant was nearing completion. Also underway, was a 1.5-million-ton-per-year expansion of the Siam City Cement Co. plant in Saraburi, scheduled for completion in 1981.

Current and planned capacity of the cement industry in Thailand is as follows in metric tons:

	1979	1980	1981	1982	1983
Siam Cement Co	3,730,000	4,140,000	5,780,000	5,780,000	5,780,000
Siam City Cement Co	660,000	660,000	2,160,000	2,160,000	2,160,000
Jalaprathan Cement Co	907,500	907,500	907,500	907,500	2,587,500
Thanabhumi Cement Co	--	--	--	--	1,249,000
Total	5,297,500	5,707,500	8,847,500	8,847,500	11,776,500

Completion of this ambitious construction program would alleviate the current shortage.

Fluorite.—Fluorite was one of Thailand's more important mineral industries employing over 3,400 persons in 52 active mines in mid-1980. Mining activity increased during the first half of 1980 as did production. Output of low-grade ore, in particular, showed a substantial increase. This ore was generally beneficiated into an acid-grade fluorite and exported. Japan was Thailand's best customer for the acid-grade material, taking over 78% of the 1979 production.

BOI was considering the possibility of establishing downstream fluorite-based industries in Thailand. Development of these industries would increase overall value of domestic fluorite output, create new job opportunities, and considerably increase foreign exchange earnings.

Salt and Potash.—Discussions continued about the planned soda ash factory which was to be Thailand's Association of Southeast Asian Nations (ASEAN) development project. Soda ash was a major Thai import, and development of the soda ash industry and its related chemical plants would be beneficial to the Thai economy by reducing the balance of trade deficit and employing a considerable work force.

An agreement was reached during 1980 on the equity ratio between Thailand and the other ASEAN countries involved in the development of the mines and industrial facilities. Under the final agreement, Thai-

land will hold 60% of the equity, Malaysia, Indonesia, and the Philippines will hold 13% each, and Singapore, which had doubts about the projects commercial viability, will hold 1%. Thailand set up the Rock Salt and Soda Ash Holding Co., Ltd., to manage its interests. The Thai ownership was 34% by the Government and 66% by 10 private Thai companies who are soda ash consumers.

Plans call for a rock salt mine to be opened at Bamnet Narong (15°30'N, 101°42'E) in Chaiyaphum Province, with the limestone mine to be located in Saraburi Province. Reserves at the mine sites were good for many decades of production. The final site for the soda ash plant was to be either Sattahip, Laem Chabang, or Rayong, all of which are on the coast and along the alinement of the natural gas pipeline.

The Department of Mineral Resources has reportedly rejected a proposal from Amax Exploration, Inc., for exploring and developing a promising potash deposit at Wanon Niwat (17°40'N, 103°45'E) in Sakon Nakhon Province. The Government was asking for one bid for the exploration work and a separate bid for the development work, with the exploration company having no priority claim to the later work. Amax would like developmental rights before making a large investment in a detailed exploration of the deposit. Amax remained interested despite the impasse, and the Thai Government will continue negotiating with the company, which remained the sole applicant for the potash concession.[11]

The Thai potash occurrence was the only large high-grade deposit known in the Southeast Asia area, but its development will require a great deal of capital investment because of the remoteness of the deposit.

MINERAL FUELS

Lignite.—With respect to the world's rapidly rising energy costs, Thailand's once economically marginal lignite deposits have taken on considerable new importance. Most of the Thai lignite production was used for electric power generation at the mine sites. The Thai Government has embarked on an extremely ambitious expansion program of the Mae Moh (18°16'N, 99°43'E) lignite mining and power generation complex. Currently two units of 75 megawatts each were operating in 1980. A third 75-megawatt unit was due online in early 1981, and a fourth unit of similar size was due online by the end of 1981. Two 150-megawatt units were scheduled for mid-1980 operation and three 300-megawatt units are scheduled to be built by 1987. The Electricity Generating Authority of Thailand (EGAT) has been studying the possibility of using a fluidized bed combustion technology for units 6 through 9. A mining expansion program was planned to keep the mine's production capacity in line with future increase in demand.

A detailed evaluation of the lignite reserves in the Mae Moh Basin was being undertaken by an Australian engineering team. A high-resolution seismic survey will delineate the basin structure and seam thickness. A large number of noncored holes will be drilled and wireline logged to determine lignite occurrence and quality.

EGAT has not ignored the search for additional lignite reserves. A new deposit was discovered in the Mae Ramat district (17°10'N, 98°30'E) of Tak Province, while drilling for oil shale. EGAT has applied for a $1.5 million loan to finance a detailed survey of this deposit which was believed to be several times the size of the Mae Moh deposit.

Drilling confirmed two small coal deposits in Lampang Province. The coal had the same heat value as the Mae Moh lignite and total reserves were estimated at 58 million tons.

Natural Gas and Petroleum.—During 1980, a 425-kilometer-long natural gas pipeline was being laid in the Gulf of Thailand from the Union Oil Co.'s gas discovery to emerge onshore near Rayong. Concurrently, a 160-kilometer-long onshore segment was being laid from Rayong to the Bangkok metropolitan area. The 86-centimeter pipeline was currently the longest submarine pipeline under construction in the world and would cost over $500 million when completed. The line, and supporting offshore and onshore facilities, were scheduled for completion in late 1981. The line is projected to begin operating at a rate of 250 million cubic feet per day, with all of the initial output going to the generation of electric power. The pipeline was designed for a 500-million-cubic-foot-per-day capacity. This will be reached when a planned 110-kilometer extension is completed to the Texas-Pacific Co.'s gasfield southeast of Union Oil Co.'s present development.

This energy development project was designed to reduce Thailand's dependence on foreign oil imports and lower the balance of trade deficit. In 1980, Thailand spent nearly

$3 billion for crude oil and refined product imports, exceeding the trade deficit for the year.

As more development drilling was done in the Gulf of Thailand, total gas reserves increased to over 9 trillion cubic feet. In addition to its primary use in electric power generation, the increased reserve situation would allow development of natural resources, which are high energy consumers.

In particular, the gas could be used to fuel the proposed soda ash and sponge iron plants or any of several petrochemical projects. At yearend 1980, there was still no price agreement with the Government for the development of the discoveries in the Texas-Pacific Co. concession area or for Union Oil Co.'s Block 10 discovery.

According to Petroleum Authority of Thailand (PAT), plans were going ahead for the expansion of the Thai Oil Refining Co. (TORC) refinery from 65,000 to 165,000 barrels per day despite political pressure to revise the agreement. By the terms of the agreement, PAT and the Crown Property Bureau will own 49% and 2%, respectively, while TORC and Royal Dutch/Shell Corp. would own the remaining 49%. The expansion would cost around $580 million. If there were no delays, a contractor would be chosen in 1981. There was no progress in 1980 concerning the often discussed plans to expand the capacity of the ESSO and Summit Industrial Corp., Ltd., oil refineries. Prospects for the construction of a new fourth refinery were also uncertain at yearend 1980. Although all parties agreed that new refining capacity was urgently needed, the subject was politically sensitive. Ownership, financing, and distribution of profits were the points of contention rather than technical or engineering problems.

The country's three large refineries operated entirely on imported crude oil, mostly from the Persian Gulf countries. In 1979, Saudi Arabia, Qatar, the United Arab Emirates, and Kuwait together supplied 82% of Thailand's crude requirements. Thai crude oil import volume fell 3.6% in 1980, while the value rose 66%. The Persian Gulf countries still supplied 81% of the total.

The import situation will change somewhat when the natural gas begins flowing in 1981. The main change will be a drop in demand for heavy fuel oil as the thermal powerplants switch over to natural gas. In addition, several thousand barrels per day of light-end gas condensates will also be available as a natural gas byproduct.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Thai baht (B) at the rate of B20.42=US$1.00 in 1980 and 1979, and B20.34=US$1.00 in 1978.

[3]U.S. Embassy, Bangkok, Thailand. State Department Airgram A-19, Economic Situation and Trends in Thailand. Mar. 2, 1981, p. 2.

[4]Asian Wall Street Journal. V. 5, No. 44, p. 3.

[5]Work cited in footnote 3.

[6]Bank of Thailand. Monthly Bulletin. V. 20, No. 10, October 1980, p. 35.

[7]Business in Thailand. The Tantalite War. July 1980, pp. 22-29.

[8]Pages 44 and 45 of work cited in footnote 6.

[9]Mining Magazine. V. 142, No. 6, June 1980, p. 560.

[10]Engineering and Mining Journal. V. 182, No. 1, January 1981, p. 151.

[11]Engineering and Mining Journal. V. 181, No. 5, May 1980, p. 190.

The Mineral Industry of Tunisia

By E. Shekarchi[1]

While petroleum and phosphate rock exports earned $560 and $61 million in foreign exchange, respectively, for Tunisia in 1980, activities in other areas such as iron ore shipments, steel output, lead, zinc, and cement production were not insignificant. Cement production continued to be a national priority as Tunisia strived to become self-sufficient in this area. Toward this end, the Government allocated $75 million, half of which went to the Jebel Oust cement project. During 1980, cement production reached a new high of 1.4 million tons, necessitating imports of cement from Spain, the U.S.S.R., and Turkey.

Total production of phosphate rock in 1980 reached 4.2 million tons, an improvement over 1979 production but still well below the goals of the Fifth Development Plan (1977-81). Failure to reach planned levels can be traced to a number of factors. First and foremost, the plan to double annual phosphate production from 3.5 to 7 million tons in 5 years proved unrealistic. Rather than implement their expansion program in stages, the Tunisians tried to do everything at once, and the personnel and infrastructure were insufficient for the task. In 1980, the management of Cie des Phosphates de Gafsa (CPG) announced that it would soon transfer its headquarters from Tunis to Metlaoui, site of one of the largest phosphate mines, in order to communicate better with all the operating mines. One-third of all phosphate production was exported and the remainder was used in the domestic chemical industries to produce phosphoric acid and its derivatives. Phosphoric acid exports earned $80 million during 1980.

The Tunisian economy continued its vigorous growth of previous years with about a 5% increase in 1980. This increase brought the per capita gross national product (GNP) to about $1,120, which was an achievement for a developing country. However, one of the most important problems facing the Tunisian economy, open and hidden unemployment, remained unchecked. In 1980, an estimated 250,000 people were unemployed. In addition, there was considerable hidden unemployment in the agricultural sector. The Government was aware of this serious situation and gave high priority to creating new jobs and educating and training workers to qualify for job openings in the future.

In the latter part of 1979, after some construction tenders had been announced, the Government suspended further consideration of the Miskar offshore gas project. The main reason for the cancellation of the project was the lack of proven reserves. The proven reserves of the field were found, after the drilling of two additional confirming wells, to be less than expected. As a result, Miskar offshore gasfield has been put in the bank to wait for the higher internal rate of return that future energy price rises will bring. The gasfield will also serve as a useful hedge against the failure to find new commercial petroleum fields.

The proposed expansion of the Bizerte refinery capacity from 1.5 million tons to 4 million tons per year, another major 5-year plan (1977-81) energy sector project, was delayed but will probably be started late in 1981. During 1980, a consulting engineer was selected, and construction tenders were to be issued in the late 1980's.

PRODUCTION AND TRADE

Continuation of the improvement in Tunisia's balance of payments in 1980 depended in large measure on exogenous factors, such as the price of petroleum and the price of phosphate rock and new chemical fertilizer exports from Gabes facilities on the international market. By the end of the year, the overall trade balance was reported at $1.1 billion, with a surplus in the service account of about $500 million. Production of minerals as well as exports and imports of mineral and some semimanufactured-related materials are presented in tables 1, 2, and 3.

Table 1.—Tunisia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Iron and steel:					
Iron ore and concentrate, gross weight thousand tons	495	344	339	394	389
Metal:					
Pig iron do	103	132	134	150	151
Steel, crude do	103	156	159	176	178
Lead:					
Mine output, metal content	10,364	10,249	8,009	10,021	8,310
Metal:					
Primary[3]	19,702	19,200	16,074	16,163	19,195
Secondary[e]	700	500	500	600	600
Total	20,402	19,700	16,574	16,763	19,795
Silver metal, primary thousand troy ounces	257	236	281	231	235
Zinc, mine output, metal content	7,345	7,081	7,392	8,706	7,579
NONMETALS					
Barite	23,400	16,049	16,358	16,358	26,949
Cement, hydraulic thousand tons	478	572	882	1,383	1,780
Clays, construction do	195	200	210	[e]220	[e]210
Fluorspar, chemical and metallurgical grade	34,500	28,857	33,258	33,808	39,451
Gypsum	38,800	[e]40,000	[e]40,000	[r e]60,000	[e]75,000
Lime, hydraulic thousand tons	318	338	427	430	529
Phosphate rock, gross weight do	3,301	3,615	3,712	4,154	4,502
Salt, marine do	480	405	425	400	437
MINERAL FUELS AND RELATED MATERIALS					
Gas:					
Manufactured million cubic feet	[e]700	NA	NA	NA	NA
Natural:					
Gross do	15,891	25,815	24,438	[e]27,600	[e]28,000
Marketed do	7,554	9,923	9,390	10,824	[e]11,600
Petroleum:					
Crude thousand 42-gallon barrels	28,600	34,675	36,500	38,113	[e]38,700
Refinery products:					
Gasoline do	1,104	1,199	1,270	[e]1,200	[e]1,200
Kerosine do	833	791	1,267	[e]1,200	[e]1,770
Distillate fuel oil do	2,415	2,536	2,365	[e]2,300	[e]2,400
Residual fuel oil do	3,241	3,383	3,341	[e]3,300	[e]3,400
Other do	649	957	399	[e]600	[e]600
Refinery fuel and losses do	790	156	710	[e]400	[e]500
Total do	9,032	9,022	9,352	[e]9,000	[e]9,870

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 24, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) is produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]From domestic and imported ores.

Table 2.—Tunisia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	206	119	[1]	West Germany 49; Belgium-Luxembourg 49; Italy 20.
Copper:				
Matte	[1]	221	--	Mainly to Belgium-Luxembourg.
Metal including alloys, all forms	359	653	[1]	Belgium-Luxembourg 539; France 74; West Germany 40.
Iron and steel:				
Ore and concentrate	24,981	--		
Metal including alloys:				
Scrap	1,280	14	--	All to Italy.
Pig iron, ferroalloys, similar materials	--	108	--	All to U.S.S.R.
Steel, primary forms	20,400	5,797	--	All to Italy.
Semimanufactures	894	11,672	1	Libya 11,093; Algeria 235.
Lead metal including alloys, all forms	12,158	11,675	--	Italy 8,067; Greece 2,954; Egypt 500.
Tin metal including alloys, unwrought and waste ---- kilograms	--	470	--	All to U.S.S.R.
Zinc:				
Ore and concentrate	3,525	6,421	--	Italy 4,624; France 1,797.
Metal including alloys, all forms	[1]	11	--	U.S.S.R. 6; Algeria 3; Greece 1.
Other:				
Ash and residue containing nonferrous metals	33	151	--	All to Italy.
Ash, waste, sweepings of precious metals	9	7	--	All to France.
Base metals including alloys, all forms, n.e.s ---- kilograms	--	742	--	All to U.S.S.R.
Oxides, hydroxides, peroxides, n.e.s	3	77	--	Algeria 75; France 2.
NONMETALS				
Abrasives, natural	2	10	--	U.S.S.R. 9; West Germany 1.
Asbestos ---- kilograms	--	1,140	--	U.S.S.R. 860; Algeria 280.
Barite and witherite	1,109	200	--	All to Algeria.
Cement	--	80	--	Mainly to Malta.
Clays and clay products (including all refractory brick):				
Crude	25	--		
Products	9,261	376	--	Egypt 236; Algeria 140.
Fertilizer materials:				
Crude, phosphatic ---- thousand tons	1,669	1,598	--	France 456; Poland 241; Greece 213.
Manufactured:				
Nitrogenous	10	[1]	--	All to Italy.
Phosphatic	458,256	543,067	--	France 108,726; Italy 86,849; West Germany 47,260.
Other including mixed	41,972	55,754	--	Italy 34,604; France 15,450; Iceland 3,200.
Ammonia	11,557	450	--	All to Italy.
Graphite, natural	--	12	--	All to France.
Pigments, mineral, natural, crude	--	75	--	All to Libya.
Precious and semiprecious stones except diamond ---- thousand carats	430	680	--	All to Belgium-Luxembourg.
Pyrite, gross weight	--	80	--	All to Libya.
Salt and brine	382,618	352,050	56,273	Italy 74,226; Bulgaria 49,800; Yugoslavia 32,755.
Stone, sand and gravel:				
Stone:				
Dimension, crude and partly worked	28	20	--	All to West Germany.
Limestone except dimension		3,130	--	All to United Kingdom.
Gravel and crushed rock	2	1	--	All to Spain.
Sand excluding metal-bearing	10	2	--	Spain 1; Italy 1.
Sulfuric acid including oleum	10,151	7,699	--	Libya 3,173; Greece 3,150; Algeria 1,376.
MINERAL FUELS AND RELATED MATERIALS				
Gas, hydrocarbon, natural	[1]	301	--	All to Italy.
Petroleum:				
Crude ---- thousand 42-gallon barrels	33,769	42,164	8,253	Greece 12,750; Italy 6,709; France 5,203.
Refinery products:				
Gasoline ----do	1	1	[1]	Mainly to France.
Kerosine ----do	407	853	--	Greece 68; France 30.
Distillate fuel oil ----do	85	139	2	Greece 68; Cyprus 14; Singapore 10.
Residual fuel oil ----do	143	234	1	Greece 141; Liberia 23; Singapore 19.
Lubricants ----do	1	[1]	[1]	Mainly to Libya.
Other ----do	537	698	--	Italy 294; Netherlands 140; United Kingdom 140.
Total ----do	1,174	1,925		

[1]Less than 1/2 unit.

Table 3.—Tunisia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	21	382	--	All from Canada.
Semimanufactures	2,715	2,519	33	France 796; Italy 780; Belgium-Luxembourg 230.
Arsenic oxides, hydroxides, acids, kilograms	4	40	--	West Germany 35; United Kingdom 5.
Chromium oxides and hydroxides	22	25	--	West Germany 13; Belgium-Luxembourg 7.
Copper:				
Copper sulfate	--	126	--	Yugoslavia 90; France 16; Italy 10.
Metal including alloys, all forms	2,987	2,963	(1)	France 2,054; Italy 487; Belgium-Luxembourg 335.
Gold metal, unwrought or partly wrought, troy ounces	19,387	21,766	--	Switzerland 20,255; France 1,511.
Iron and steel metal:				
Scrap	2,487	483	5	NA.
Pig iron and ferroalloys	1,555	2,204	--	Yugoslavia 1,197; Portugal 470; France 303.
Sponge iron, powder, shot	282	565	--	France 465; Italy 89; Spain 10.
Steel, primary forms	5,001	6,385	--	West Germany 5,248; Italy 1,133.
Semimanufactures	143,318	301,008	619	Italy 117,162; France 101,008; West Germany 20,921.
Lead:				
Ore and concentrate	1,456	8,277	--	Morocco 7,262; Algeria 1,015.
Oxides	91	144	--	France 74; Spain 50; West Germany 20.
Metal including alloys, all forms	11	24	--	Belgium-Luxembourg 13; France 11.
Magnesium metal including alloys, all forms	5	16	15	NA.
Mercury, 76-pound flasks	103	166	--	Algeria 116; Spain 30; United Kingdom 19.
Molybdenum metal including alloys, all forms, kilograms	228	193	--	Austria 124; Sweden 66; West Germany 3.
Nickel metal including alloys, all forms	13	62	--	France 48; Italy 13.
Platinum-group and silver metals including alloys, unwrought or partly wrought:				
Platinum-group, troy ounces	161	2,926	--	All from France.
Silver, do	23,824	29,546	--	West Germany 6,719; France 4,887; Italy 2,411.
Tin:				
Oxides, kilograms	25	235	--	France 200; Italy 35.
Metal including alloys, all forms	63	86	--	Indonesia 44; Malaysia 16; France 9.
Titanium oxides	291	379	--	West Germany 132; Italy 116; Belgium-Luxembourg 65.
Tungsten metal including alloys, all forms, kilograms	446	250	--	France 204; United Kingdom 28.
Uranium and thorium compounds, do	1,651	895	--	France 872; West Germany 23.
Zinc:				
Oxides and peroxides	169	131	--	France 94; Belgium-Luxembourg 30.
Metal including alloys, all forms	1,093	964	--	Spain 465; France 345; West Germany 101.
Other:				
Ores and concentrates, n.e.s	4,190	115	--	Italy 100; United Kingdom 10.
Oxides, hydroxides, peroxides, n.e.s	499	376	314	France 48; West Germany 12.
Ferrocerium and pyrophoric alloys	1	4	--	France 2; West Germany 1.
Radioactive metal isotopes, n.e.s	2	3	(1)	Mainly from France.
Metals including alloys, all forms, n.e.s	84	44	(1)	Belgium-Luxembourg 20; Spain 17; United Kingdom 6.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, natural corundum, etc	94	159	--	France 91; Italy 68.
Grinding and polishing wheels and stones	480	449	(1)	Italy 355; France 42; Austria 11.
Asbestos	1,749	3,658	15	Canada 1,889; U.S.S.R. 973; Mozambique 591.
Barite and witherite	1,568	2,480	--	Italy 1,517; Portugal 279; United Kingdom 255.
Boron materials:				
Crude natural borates, kilograms	38	44	--	All from France.
Oxide, acid, refined borates, perborates	211	485	90	France 327; Italy 62.
Cement	676,439	558,653	1	Spain 191,342; Turkey 102,941; Yugoslavia 79,230.
Chalk	469	509	--	France 494; West Germany 15.
Clays and clay products:				
Crude	15,034	21,450	327	Italy 5,819; United Kingdom 5,150; Spain 4,153.
Products:				
Refractory (including nonclay brick)	8,238	4,796	--	West Germany 1,443; France 915; Italy 683.
Nonrefractory	8,302	9,319	--	Spain 5,222; Italy 2,936; France 984.
Diatomite and other infusorial earth	137	169	6	France 163.
Feldspar and fluorspar	1,686	3,149	--	Italy 1,718; France 1,431.

See footnotes at end of table.

Table 3.—Tunisia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude, phosphatic	1,801	1,000	--	Mainly from Belgium-Luxembourg.
Manufactured:				
Nitrogenous	54,484	96,309	(1)	Poland 40,057; Netherlands 28,803; Bulgaria 14,955.
Phosphatic kilograms	160	50	--	All from France.
Potassic	6,719	12,228	--	Spain 7,677; Italy 4,550.
Other including mixed	1	5	--	West Germany 3; France 2.
Ammonia	14,057	5,410	5,000	France 307; Belgium-Luxembourg 38; Netherlands 38.
Graphite, natural	(1)	3	--	All from France.
Gypsum and plasters	169	215	--	France 214; Italy 1.
Lime	3	7	--	All from France.
Magnesite	2	89	--	All from Greece.
Mica, all forms	34	79	55	United Kingdom 20.
Pigments, mineral, including processed iron oxides	243	182	--	West Germany 150; France 19.
Precious and semiprecious stones except diamond thousand carats	930	625	25	Belgium-Luxembourg 570; West Germany 25.
Salt and brines	79	36	--	France 25; Netherlands 6; West Germany 5.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	14,329	18,082	--	France 15,706; Spain 1,100; Italy 864.
Caustic potash and sodic and potassic peroxides	13	14	--	France 9; West Germany 5.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	12,289	11,933	--	Mainly from Italy.
Worked	84	338	--	Do.
Dolomite, chiefly refractory grade	68	207	--	Italy 183; France 24.
Quartz and quartzite	1,299	555	--	Belgium-Luxembourg 515; Italy 38.
Gravel and crushed rock	10,156	15,780	--	Italy 15,729; France 51.
Sand excluding metal-bearing	66	485	--	Netherlands 450; West Germany 17.
Sulfur:				
Elemental, all forms	371,584	581,665	32,467	Canada 188,981; France 178,039; Poland 122,297.
Sulfuric acid including oleum	476	888	(1)	France 642; Netherlands 175; Belgium-Luxembourg 60.
Talc, steatite, soapstone, pyrophyllite	1,580	1,676	--	France 1,080; Italy 476; Spain 82.
Other:				
Oxides and hydroxides of magnesium, strontium, barium	12	16	--	Mainly from Netherlands.
Meerschaum and amber kilograms	--	100	--	All from Italy.
Slag, ash, and similar waste, not metal-bearing	(1)	2	--	All from France.
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetals, n.e.s	1,746	395	(1)	Mainly from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	290	496	5	Hungary 491.
Carbon black	305	319	--	Italy 244; France 56; West Germany 15.
Coal, all grades, including briquets	27,085	32,739	(1)	France 10,571; U.S.S.R. 8,572; Morocco 7,385.
Coke and semicoke	94,488	120,299	--	West Germany 110,506; Italy 9,793.
Hydrogen and other rare gases	34	53	(1)	West Germany 18; France 13.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	6,963	10,738	--	Saudi Arabia 6,972; Iraq 3,650; Algeria 116.
Refinery products:				
Gasoline do	7	9	--	Mainly from Italy.
Kerosine do	1,922	2,105	--	Greece 1,472; Italy 605.
Distillate fuel oil do	5,039	3,489	--	Italy 1,624; Greece 1,597.
Residual fuel oil do	1,096	654	--	Greece 435; Italy 219.
Lubricants do	211	172	4	Italy 137; France 27.
Others:				
Mineral jelly and wax do	6	12	--	France 5; Spain 3; Romania 2.
Bitumen do	140	130	--	Mainly from Italy.
Bituminous mixtures, n.e.s do	18	19	--	Italy 14; Hungary 3; France 2.
Liquefied petroleum gas do	846	1,048	--	Italy 757; Algeria 120; Libya 83.
Other do	(1)	(1)	--	NA.
Total do	9,285	7,638		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	45	62	12	France 26.

NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Iron and Steel.—Since Douaria and Tamera Mines were exhausted, all production of iron ore was from the Djebel Djerissa Mine located approximately 40 miles west of Bizerte. The ore, with a 52% iron content, was consumed in domestic industry. Tunisia operated a small but fully integrated steel mill, El Fouladh, at Menzel Bourgba, near Bizerte. Total capacity of the mill was reported to be about 180,000 tons. Downstream products of the El Fouladh consisting of bars and rods of various diameters, were down to one-half millimeter in diameter, and a limited range of steel structures were primarily consumed locally.

The expansion plans for El Fouladh by adding two electric furnaces, which have been under discussion for years, remained undecided. Whether or not this project is ever implemented, Tunisia soon will have to turn to the international market to meet its iron ore demand. The iron ore reserves estimated in 1980 ranged from 2 to 4 million tons, and all efforts of exploration to find new ore bodies had failed.

Lead and Zinc.—Tunisia continued to mine lead and zinc in 1980, but owing to exhaustion of the mine and generally antiquated equipment, mine production remained about 15,000 tons for both metals. Exploration activities by the Société Tunisianne d'Expansion Minére, the only lead-zinc producer in the country, remained low key. An American firm, Golder Associates, was selected in 1980 to do a feasibility study for the upgrading of the Fedj Hassene lead-zinc mine, where a low grade of lead-zinc in substantial quantities has been reported in the past. Most of the lead production of Tunisia was consumed domestically, while a significant portion of zinc concentrates were shipped to European markets.

Other Minerals.—Tunisia produced a limited amount of silver as a byproduct from lead-zinc mining and mercury for cosmetic markets. A small amount of arsenic was produced from the Tabett ben Ksouri deposit to satisfy domestic consumption.

NONMETALS

Cement.—Tunisia produced $1.4 million tons of cement in 1980, about one-half million tons short of domestic consumption. The Société Les Ciments Tunisians, a Government-organized company, continued to administer the building of a cement plant near Jebel Oust. This plant was expected to come into production in 1984. The plant would cost close to $200 million and have a capacity of 1 million tons. The asbestos cement products plant, with a capacity of 26,000 meters of pipe per year, went into full operation in 1980. Most of the product was used domestically, primarily for irrigation and sanitation purposes.

Fertilizer Materials.—Phosphate rock production by the State-owned CPG reached a new high of 4.2 million tons of concentrate in 1980. One-third of this was exported to European markets, and the remainder was processed in the domestic chemical industries. Domestic chemical industries produced phosphoric acid, triple superphosphate, phosphate animal feed, and other phosphate derivatives, mostly for export. In 1979, phosphoric acid exports earned $78 million and total superphosphate fertilizer exports were worth $80 million. In sum, phosphate and phosphate derivatives represented 11% of total merchandise export earnings, to rank third in importance behind crude oil and textiles.

Eight major phosphate mines were operating in 1980. All but one, the new Kef Echfaier Mine near Metlaoui, were underground. The five older mines at Metlaoui, Kaiaa Khasha, Moulares, Redeyef, and M'Dilla underwent various forms of modernization, ranging from construction of new washeries to application of recent technologies in ore extraction. The three new centers at M'Rata, Kef Echfaier, and Sehib were expected to provide at least half of Tunisia's total phosphate rock production within the next few years.

As mentioned, two-thirds of Tunisian phosphate production was used domestically to produce chemicals and fertilizers. The older plants were located in Sfax and Tunis, and the new centers of industry were located in Gabes, where several huge new plants—the largest of which were the Industries Chimiques Maghrebines (ICM) and Société Arabe des Engrais Phosphates et Azotes (SAEPA) complexes—began operation in the late 1970's.

ICM produced 250,000 tons per year of phosphoric acid, of which 190,000 were exported and the rest was used to make 100,000 tons of triple superphosphate and 60,000 tons of phosphate animal feed per year, mostly for export. In 1979, Hitachi of

Japan won a contract to expand ICM's production base to produce an additional 190,000 tons per year of phosphoric acid by 1982.

SAEPA, so titled because of a 40% equity share by the Abu Dhabi Development Fund, began production in late 1979. SAEPA produced 330,000 tons per year of phosphoric acid, of which 270,000 tons were exported and the rest was used to manufacture 330,000 tons of diammonium phosphate fertilizer per year.

Gabes Chimie Transport, an affiliate of ICM, owned three phosphoric acid tankers with a total capacity of over 25,000 tons that were used to deliver fertilizer products to Tunisia's customers around the world. Planned investment in the phosphate mining sector for 1980 totaled $41 million, which was a significant decrease from 1979 levels of almost $90 million. A major reason for the decrease was the financial situation of CPG. Another reason was the gap between the production costs of CPG and selling prices. Losses totaled about $46 million in 1979 and resulted in drastic changes in the top management of the company and a strict control on its capital expenditures. Even with the reforms and higher world phosphate prices, however, CPG faced large losses in 1980. Investment in the chemical and fertilizer industries in 1980 was also decreased substantially, from $107 million to $44 million.

Other Nonmetals.—Production of fluorite and barite remained at the same level of 1979 output. Most of the fluorite was consumed by the Industries Chemiques de Fluor in producing aluminum fluoride. Since the market for barite was limited by demand for drilling in the petroleum industry, barite was stockpiled at the mining site. Production of gypsum and lime, which were used mostly in the housing industry, remained at the same level as in 1979.

MINERAL FUELS

Between 1977 and 1980, exploration efforts in Tunisia identified about 50,000 barrels per day of new petroleum that could be commercialized by 1985. This amount probably would not meet Tunisia's net export requirement of 2.5 million tons per year projected in the last 5-year plan. Tunisia, with a declining petroleum production and increasing domestic consumption, eagerly expected production from Isis Oilfields. However, Isis Oilfield was in the disputed offshore area between Tunisia and Libya. Although the two countries have asked the International Court of Justice to advise them on a formula that could be used to draw mutually accepted boundaries, the court will not render its opinion until 1982. It seemed that by mid-1980, Tunisia would have to rely on imports of refinery products while exporting its petroleum to the international market at premium prices.

Crude petroleum production in 1980 totaled 5.6 million tons, compared with 5.3 million tons in 1979. About 93% of 1980 petroleum production was from two fields: El Borma and Ashtart. No new concession was brought onstream in 1980. A slight production increase in 1980 allowed Tunisia to maintain a petroleum export surplus of 2.5 million tons, which earned about $550 million in foreign exchange in 1980. The El Borma Field was utilizing secondary recovery techniques in 1980, and although production there was projected to rise still further in 1981 and 1982, it could drop off very sharply thereafter.

Although the expansion of Tunisia's only petroleum refinery at Bizerte was postponed until 1981, the refinery produced 1.5 million tons of products in 1980 (mainly using imported Saudi Arabian and Iraqi crude). In addition, Tunisia imported 700,000 tons of refined petroleum products, mainly from refineries in Italy.

By the end of 1980, about 21 permits for petroleum exploration, covering an area of approximately 155,000 square kilometers, was still valid. There were 14 expansion and development wells completed. In most of the exploration permits, the oil company or companies formed a 50% partnership with the Tunisian State oil company, Enterprise Tunisienne des Activites Petroliers (ETAP). ETAP was to reimburse its share of exploration expenses only in the case of a commercial find, otherwise the companies were to absorb all of the exploration expenses. By the end of 1980, new permit holders were required to commit a specific number of wells and/or investment figures during the life of the permit.

[1]Supervisory physical scientist, Branch of Foreign Data.

The Mineral Industry of Turkey

By Peter J. Clarke[1]

The Turkish economy and Government underwent major structural reforms in 1980 in an attempt to solve the problems of economic stagnation and eliminate the political infighting that had paralyzed the country. Several years of restrained economic growth, rapidly rising rates of inflation, high unemployment, and massive balance-of-payment deficits had combined to erode the confidence of international creditors and placed the country in a nearly irretractable economic slump. Partly to blame for the condition of the economy was the soaring oil import bill, which exceeded total foreign exchange receipts for commodity exports in 1980. In January 1980, a major economic reform package was instituted to restore the health of the economy. The first half of the year showed little improvement, but in the second half the inflation rate began to slow, and imports and exports began to pick up. The overall rate of economic growth, as reflected in the country's gross national product, declined in 1980, as it has every year since 1974. Industrial production was down 4% in 1979, and dropped another 0.5% in 1980, which indicated the partial recovery of the manufacturing sector during the year. International loans for investment and balance-of-payments assistance were necessary to keep the economy stabilized while the reform program began to take effect.

Despite its large reserves of various minerals, the mining sector contributed approximately 3.7% of Turkey's gross domestic product. Total mineral production decreased 5.4% from that of 1979. The decline in production was due, in part, to the Government's nationalization of major mines, which was authorized by Law No. 2172 of October 19, 1978 (Mines Expropriation Law). The Government took control throughout 1978 and 1979 of major iron ore, lignite, boron, and magnesite mines. Once in control of the major deposits, Etibank, the State Economic Enterprise (SEE) responsible for mineral production, did not possess sufficient funds for the necessary capital investments to get the mines operating. Production in all sectors, except lignite, declined.

Recognizing that Etibank was unable to increase the productivity of the nation's mines, the Council of Ministers, in June 1980, published a decree authorizing the return of nationalized mines to their original owners, under several conditions. Before the Ministry of Energy could begin returning the mines, the Supreme Administrative Court issued a restraining order at the request of Maden-Is, the mineworkers' trade union, questioning the authority of the Council of Ministers to rescind a law enacted by the Parliament. At the end of the year, the Government was preparing a bill to submit to the Parliament to authorize the return of the mines.

These changes in the ownership of the nation's mines were part of a sweeping reform program, instituted in January 1980, to strengthen the economy and allow market forces to operate more independently. These measures were to coincide with a nearly $2 billion[2] loan agreement provided by the Organization for Economic Cooperation and Development (OECD) members and the International Monetary Fund for balance-of-payments assistance. In addition, OECD members agreed to reschedule about $5 billion in official and officially guaranteed debts owed by Turkey.

Among the reforms instituted under the Government of Prime Minister Suleyman

Demirel were a 35% devaluation of the lira against the dollar, raising interest rates on bank advances, and partial decontrol of oil and coal prices. The main objectives of the plan were to boost exports, open the economy to foreign investment, and slow the annual rate of inflation, which had been running at nearly 100%. Many sectors of the economy, including mining, which had been allowed little access to foreign capital, were to be opened. Investments could be made in any area not nationalized by the Council of Ministers. Passage of the return of expropriated mine bills would make accessible many profitable mining ventures to multinational companies. Metal and nonmetallic processing industries were also opened to foreigners. Non-Turks were allowed to own between 10% and 49% of most companies' equities. However, in some industries, mainly export oriented where there is no competition with Turkish companies, foreigners were allowed 100% ownership.

The petroleum industry, which was much in need of foreign expertise and money, was also liberalized. Foreign companies were allowed to export 35% of their oil production, and exploration licenses were granted for many regions, including those under the control of the state-owned Turkiye Petrolleri Anonim Ortakliki (TPAO).

In addition to economic problems, Turkey suffered from political instability as well during 1980. Citing the inability of the elected Government to effectively govern the country, the Turkish Armed Forces took power on September 12, 1980, as they did in 1960 and 1971. The military Government pledged to continue the economic reforms initiated under the previous Government, and to return the country to parliamentary democracy as soon as was practically possible.

PRODUCTION

Total production from the mineral sector in 1980 declined 5.4% from the 1979 level. Still, Turkey remained a major producer of several minerals, notably chromite and boron, in which Turkey ranked fifth and second, respectively, in terms of world output. Production of most commodities remained low, however, for several reasons. Demand was low, owing to a nearly stagnant economy, and the lack of foreign exchange crippled most of the SEE's capital replacement and development plans. Labor unrest and frequent power cuts from electricity shortages contributed to the low production level.

The reaction to the nationalization decree that went into effect in October 1978 was an almost universal decline in output. Lignite production, which declined 4% in 1979, was the exception, showing nearly a 10% increase in production in 1980, as many older mines were brought back into production after being nationalized, and some of the newer mines were managed more efficiently. However, hard coal production continued its decline. The hard coal industry was hard hit by the lack of foreign currency to purchase equipment and machines.

Output of iron ore remained relatively stable in 1980, following the dramatic drop in production in 1979. Problems in this industry included energy shortages and lack of diesel fuel for transporting ore to the steel mill.

On the brighter side, tungsten output remained high at Etibank's Uludag tungsten operation in Bursa. Operating difficulties had been curtailing mine and mill output since the plant opened in 1977. Barite also showed a significant increase in production from 1979, owing mainly to increasing world demand for drilling muds. Petroleum production continued the long decline from the peak level of the late 1960's. Production dropped nearly 20% from the high level in 1979. Turkey began to implement secondary recovery programs to boost domestic production. A slightly improved foreign exchange situation in 1980 allowed crude oil imports to rise, and as a result, consumption increased over 7%, after the 14% drop in 1979, when funds for imports were at their lowest. Mineral production in Turkey is shown in table 1.

Table 1.—Turkey: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Bauxite	461,040	r567,200	449,124	e350,000	2416,500
Alumina	138,732	170,364	74,244	70,152	2137,508
Metal	35,500	51,300	32,300	31,800	234,200
Antimony:					
Ore, mine output:					
Gross weight	34,309	38,423	42,000	r e37,800	43,000
Metal content	1,715	1,921	2,100	1,890	22,153
Regulus	91	61	50	50	NA
Chromium:					
Chromite:					
Gross weight (34%-43% Cr_2O_3)	946,535	952,422	651,148	680,000	600,000
Salable product	580,358	508,357	e375,000	e450,000	400,000
Copper:					
Mine output, metal content	29,851	33,431	e31,250	e24,300	22,700
Metal:					
Smelter	27,672	31,524	26,220	22,212	17,200
Refined	28,300	25,300	30,100	22,200	20,000
Iron and steel:					
Iron ore, gross weight thousand tons	3,605	r3,446	3,208	e3,000	23,289
Metal:					
Pig iron and ferroalloys:					
Ferrochromium[e]	25,400	35,380	39,900	r30,000	32,000
Pig iron and other ferroalloys thousand tons	1,992	1,728	1,827	2,228	22,040
Crude steel including castings do.	1,457	1,397	1,628	1,789	21,700
Lead:					
Mine output, metal content[3]	4,926	e8,718	9,500	7,500	26,700
Metal, smelter	3,200	3,000	3,000	5,900	26,500
Manganese ore, gross weight	16,960	19,300	e20,000	r e24,000	24,000
Mercury 76-pound flasks	4,899	4,686	5,020	4,786	4,090
Silver, mine output, metal content thousand troy ounces	e220	e220	219	250	200
Tungsten, mine output, metal content	928	e1,000	e800	e1,000	e1,000
Zinc:					
Mine output, metal content[e 4]	42,750	67,100	40,700	r27,100	30,000
Metal, smelter, primary	2,300	20,900	20,000	20,000	18,000
NONMETALS					
Abrasives, natural: Emery	67,342	66,018	55,620	e55,000	40,100
Asbestos	9,941	3,975	13,372	17,210	16,000
Barite	r e100,000	143,510	32,031	e109,000	150,000
Boron materials thousand tons	912	1,099	1,320	940	900
Cement, hydraulic	12,342	13,833	15,344	13,784	14,000
Clays:					
Bentonite	23,560	4,357	8,280	e14,000	14,200
Kaolin	55,611	59,162	43,685	e59,000	50,000
Other	85,753	67,854	402,440	r e300,000	300,000
Diatomite	8,500	9,000	9,000	e9,000	9,500
Feldspar	57,800	75,200	75,300	e72,600	72,000
Fluorspar	1,282	1,711	1,253	6,200	6,000
Gypsum	32,308	65,327	60,332	e63,500	63,000
Magnesite, crude ore	409,276	516,162	417,201	510,000	500,000
Meerschaum kilograms	12,600	4,150	3,050	5,100	5,000
Nitrogen: N content of ammonia thousand tons	e90	107	217	205	250
Perlite	24,546	30,000	26,861	30,000	35,000
Phosphate rock	67,000	65,418	32,205	r e25,000	25,000
Pyrite, cuprous, gross weight	84,630	38,332	r e30,000	r e30,000	30,000
Salt, all types thousand tons	579	777	929	1,130	1,100
Sodium compounds, n.e.s.:					
Sodium carbonate[e]	55,000	60,000	65,000	70,000	60,000
Sodium sulfate	87,907	72,917	64,271	48,000	48,000
Stone, sand and gravel, n.e.s.:					
Limestone thousand tons	16,295	19,121	22,069	e20,000	20,000
Marble	113,700	118,600	122,000	130,000	130,000
Quartzite	196,276	234,643	243,210	e240,000	240,000
Sand, siliceous	23,936	27,636	67,307	e60,000	60,000
Strontium minerals: Celestite	6,400	16,600	17,500	e18,000	16,000
Sulfates, natural, n.e.s.: Aluminum sulfate (alunite)	8,250	6,402	e6,000	e6,000	6,000
Sulfur:					
Native, other than Frasch	21,000	20,040	28,000	e30,000	30,000
S content of pyrite	38,337	17,552	e13,500	e13,500	13,500
Byproduct	69,000	80,000	e80,000	70,000	70,000
Total	128,337	117,592	121,500	113,500	113,500

See footnotes at end of table.

Table 1.—Turkey: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS					
Asphalt, natural ---------- thousand tons	463	434	297	325	300
Carbon black ----------	14,100	15,808	12,254	16,000	16,000
Coal:					
Bituminous ---------- thousand tons	4,632	4,405	4,377	4,051	3,730
Lignite ---------- do	[r]13,680	[r]14,828	17,034	11,600	12,760
Coke and semicoke:					
Metallurgical ---------- do	1,824	1,740	1,690	2,625	2,600
Gashouse[e] ---------- do	472	[r]340	270	300	300
Breeze ---------- do	139	[e]135	[e]125	125	125
Total ---------- do	2,435	2,215	2,085	3,050	3,025
Gas:					
Manufactured (from coal gas plants) million cubic feet	4,792	4,752	[e]4,800	NA	NA
Natural:					
Gross ---------- do	[e]35,100	[e]36,700	36,500	36,000	30,000
Marketed ---------- do	[e]750	[e]785	794	1,200	1,000
Petroleum:					
Crude ------ thousand 42-gallon barrels	18,392	19,428	19,595	20,276	[2]16,682
Refinery products:					
Gasoline ---------- do	16,660	19,848	17,033	15,960	16,000
Jet fuel ---------- do	1,424	1,544	1,367	500	1,500
Kerosine ---------- do	4,030	4,621	4,474	3,429	3,500
Distillate fuel oil ---------- do	24,573	25,232	63,168	52,115	52,000
Residual fuel oil ---------- do	35,771	42,671			
Lubricants ---------- do	903	1,142	1,366	1,182	1,200
Other:					
Liquefied petroleum gas ---- do	4,025	4,487	4,241	4,229	4,200
Naphtha ---------- do	3,230	5,580	131	139	140
Asphalt ---------- do	1,736		2,615	1,972	2,000
Unspecified ---------- do	714		2,672	3,500	3,000
Refinery fuel and losses ------ do	4,088	4,345	3,454	1,203	1,200
Total ---------- do	97,154	109,470	100,521	84,229	84,740

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 11, 1981.

[2]Reported figure.

[3]Includes Pb content of lead and lead-zinc ores but excludes Pb content of zinc ore.

[4]Includes Zn content of zinc and lead-zinc ores but excludes Zn content of lead ore.

TRADE

Reflecting the overall decline in production and a slight improvement in foreign currency availability, mineral imports increased 32% in 1980 over that of 1979. Because of the significant increases in the price of imported oil, Turkey's total import bill rose to over $6 billion and mineral imports represented 51% of total Turkish imports in value terms. Minerals, including oil, represented only 25% of total imports in 1979.

Mineral exports, on the other hand, declined 19% from the 1979 level, after showing a 16% increase from 1978 to 1979. Minerals composed 4.2% of total Turkish exports. The major exported minerals were aluminum, barite, boron, chromite, magnesite, and tungsten. Total mineral exports were valued at around $140 million.

Turkey showed an overall trade deficit of nearly $4 billion in 1980, a major increase over the $2.8 billion deficit in 1979. The increased price of petroleum imports was largely to blame for the increase. The trade balance began to improve slightly at the end of the year, following the coup and liberalization of some of the free market barriers, and continued improvement was expected as more foreign capital entered the country under the military Government's revised regulations.

Table 2.—Turkey: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	28,725	2,600	--	All to Romania.
Oxides and hydroxides	20,870	1,500	--	Do.
Metal including alloys, semimanufactures	5,606	5,547	22	Kuwait 2,343; Syria 1,207; Iran 596.
Arsenic, natural sulfides	3	--		
Copper metal including alloys, semimanufactures, value	$2,000	--		
Chromium ore and concentrate	284,558	(1)		
Iron and steel metal:				
Pig iron, cast iron, powder, shot	19,965	17,744	--	Egypt 17,344; Syria 400.
Ferroalloys	25,291	32,075	3,500	Netherlands 18,900; Belgium-Luxembourg 4,200; Italy 3,500.
Semimanufactures	2,397	6,069	16	Iraq 2,931; Lebanon 1,780; Iran 900.
Manganese ore and concentrate	--	8,450	--	Italy 5,300; Albania 3,150.
Mercury, 76-pound flasks	8,586	2,408	--	Romania 1,450; Poland 957.
Tungsten:				
Ore and concentrate	16	--		
Metal including alloys, all forms	--	69	--	All to West Germany.
Other:				
Ores and concentrates	1,405	440	--	West Germany 220; Yugoslavia 200; Sweden 20.
Base metals including alloys, all forms	565	309	--	Bulgaria 170; United Kingdom 65; Netherlands 50.
NONMETALS				
Abrasives, n.e.s.	46,382	35,905	--	France 20,370; United Kingdom 7,870; Netherlands 7,665.
Barite and witherite	124,123	95,844	--	U.S.S.R. 86,620; Romania 7,350; United Kingdom 1,016.
Boron materials:				
Crude natural borates	690,123	621,915	63,000	Italy 125,640; France 118,210; Japan 60,950.
Oxide and acid	14,377	13,933	2,860	West Germany 4,700; United Kingdom 2,200.
Cement, thousand tons	1,240	(2)		
Chalk	2,112	5,972	--	Iraq 3,135; Libya 1,150; Lebanon 1,130.
Clays and clay products:				
Crude clays	3,482	8,119	--	Lebanon 2,750; Italy 2,635; Iraq 2,625.
Products:				
Refractory including nonclay brick	492	246	--	Pakistan 226.
Nonrefractory	3,856	9,502	--	U.S.S.R. 2,098; Iraq 2,024; Jordan 1,287.
Diatomite and other infusorial earth	5	--		
Feldspar and fluorspar	--	30	--	All to Lebanon.
Gypsum and plaster	5,000	--		
Lime	356	104	--	All to Saudi Arabia.
Magnesite	68,986	41,506	1,520	Austria 33,920; Netherlands 3,560; East Germany 2,006.
Pigments, mineral: Natural, crude	54	32	--	All to Syria.
Sodium and potassium compounds, n.e.s.:				
Soda ash	5,072	--		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	18,128	19,352	--	Syria 10,735; Italy 3,603; Switzerland 1,615.
Worked	4	28	--	West Germany 24; Saudi Arabia 3; Austria 1.
Quartz and quartzite	3	10	--	All to Mexico.
Gravel and crushed rock	16	1	--	Mainly to West Germany.
Sand excluding metal-bearing	--	400	--	All to Yugoslavia.
Sulfur: Sulfuric acid, oleum	120	--		
Talc and natural steatite	42	615	--	Libya 265; Iraq 220; Lebanon 65.
Other:				
Crude: Meerschaum, amber, jet	9	8	--	West Germany 4; Italy 3; Austria 1.
Building materials of asphalt, asbestos and fiber cements, unfired nonmetals	--	370	--	All to Libya.
Unspecified	43,990	42,200	--	West Germany 18,100; Italy 10,400; France 5,475.
MINERAL FUELS AND RELATED MATERIALS				
Coal, anthracite and bituminous	520	1,485	--	All to Iraq.
Hydrogen, helium, rare gases, value	$3,000	--		
Lignite including briquets	244,617	130,885	--	All to Romania.
Petroleum refinery products:				
Kerosine and white spirit, 42-gallon barrels	76	--		
Lubricants, do.	140	700	--	All to West Germany.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,073	532	--	All to Italy.

[1] Quantity not reported; exports valued at $26,570,000, mainly to Czechoslovakia, Italy, and the United States.
[2] Quantity not reported; exports valued at $44,893,000, mainly to Egypt and Syria.

Table 3.—Turkey: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	171	138	1	West Germany 111; France 21; Switzerland 5.
Metal including alloys:				
Unwrought	11,245	13,022	--	Canada 4,480; France 3,993; Switzerland 1,679.
Semimanufactures	1,548	870	(1)	Sweden 359; West Germany 247; France 145.
Arsenic trioxide, pentoxide, acid	81	143	--	United Kingdom 100; Belgium-Luxembourg 38; France 5.
Chromium oxides and hydroxides	264	246	--	West Germany 105; Italy 83; Belgium-Luxembourg 30.
Cobalt oxides and hydroxides	200	21	--	Belgium-Luxembourg 14; Hungary 3; Netherlands 3; United Kingdom 1.
Copper:				
Matte, speiss, similar materials	186	83	--	All from Italy.
Metal including alloys:				
Scrap	269	622	--	West Germany 221; Bulgaria 150; Netherlands 113.
Unwrought	947	2,282	--	Yugoslavia 1,675; West Germany 205; Bulgaria 126.
Semimanufactures	3,273	2,319	10	Italy 649; West Germany 465; Albania 356.
Iron and steel:				
Ore and concentrate	172,816	732,756	--	Brazil 509,893; Switzerland 129,884; Sweden 63,460.
Metal:				
Scrap	323,024	362,300	261,629	West Germany 46,892; Lebanon 27,413; Canada 25,710.
Pig iron, cast iron, powder, shot	6,119	512	--	Sweden 400; France 42; West Germany 31.
Ferroalloys:				
Ferromanganese	21,197	9,360	3,000	U.S.S.R. 2,706; Switzerland 2,623.
Other	7,396	6,443	--	U.S.S.R. 2,727; Switzerland 1,180; Republic of South Africa 1,137.
Steel, primary forms	543,611	225,417	--	U.S.S.R. 75,180; Switzerland 38,320; Japan 35,461.
Semimanufactures:				
Bars, rods, angles, shapes, sections	262,316	189,245	(1)	Switzerland 64,038; West Germany 40,021; Hungary 25,739.
Universals, plates, sheets	266,769	157,126	2,890	Japan 33,322; West Germany 29,896; Switzerland 17,191.
Hoop and strip	3,532	3,151	--	West Germany 922; Sweden 723; Austria 619.
Rails and accessories	50	4,496	116	France 4,007; Japan 296.
Wire	1,493	1,618	--	West Germany 1,018; Italy 195; Belgium-Luxembourg 133.
Tubes, pipes, fittings	17,137	20,098	1,376	West Germany 4,720; United Kingdom 3,485; Belgium-Luxembourg 2,515.
Castings and forgings, rough	4,980	1,525	1	France 1,023; Italy 184; Spain 149.
Lead metal including alloys:				
Unwrought	3,328	2,921	--	United Kingdom 960; Bulgaria 844; Belgium-Luxembourg 503.
Semimanufactures	--	61	--	All from West Germany.
Magnesium metal including alloys:				
Unwrought	14	53	10	West Germany 41; France 2.
Semimanufactures	2	--		
Manganese:				
Ore and concentrate	1,978	2,214	--	All from Belgium-Luxembourg.
Oxides	540	201	--	West Germany 182; Belgium-Luxembourg 19.
Molybdenum metal including alloys, all forms	1	1	(1)	Mainly from United Kingdom and Netherlands.
Nickel:				
Matte, speiss, similar materials	301	215	--	United Kingdom 80; Netherlands 45; Austria 38.
Metal including alloys, all forms	72	118	1	West Germany 66; Austria 18; Italy 12; Hungary 10.
Platinum-group metals including alloys, unwrought and partly wrought value	$64,000	$345,000	--	France $324,000; West Germany $17,000; United Kingdom $4,000.
Silver:				
Waste and sweepings do.	--	$3,000	--	All from West Germany.
Metal including alloys, unwrought and partly wrought do.	$85,000	$65,000	--	West Germany $54,000; Austria $5,000; France $5,000.

See footnotes at end of table.

Table 3.—Turkey: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tin:				
Ore and concentrate _ _ _ _ _ _ value _ _	_ _	$1,000	_ _	All from West Germany.
Metal including alloys, all forms _ _ _	748	321	_ _	United Kingdom 253; Malaysia 44; Switzerland 20.
Titanium oxides _ _ _ _ _ _ _ _ _ _ _ _ _ _	1,000	3,321	12	West Germany 1,001; France 788; Czechoslovakia 435.
Tungsten:				
Ore and concentrate _ _ _ _ _ _ value _ _	$6,000	_ _		
Metal including alloys, all forms _ _ _	2	5	(1)	Netherlands 3; United Kingdom 1.
Zinc:				
Oxides _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	_ _	5	_ _	All from Netherlands.
Metal including alloys:				
Blue powder _ _ _ _ _ _ _ _ _ _ _ _ _	6	10	_ _	All from United Kingdom.
Unwrought _ _ _ _ _ _ _ _ _ _ _ _ _ _	1,515	475	_ _	Italy 450; Belgium-Luxembourg 25.
Other:				
Ores and concentrates _ _ _ _ _ _ _ _ _	791	1,972	_ _	Switzerland 1,027; Sweden 656; Netherlands 227.
Metals:				
Alkali, alkaline-earth, rare-earth metals _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	7	2	_ _	Mainly from France.
Metalloids _ _ _ _ _ _ _ _ _ _ _ _ _ _	83	510	_ _	Spain 350; France 86; West Germany 71.
Base metals including alloys, all forms _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	47	_ _		
NONMETALS				
Abrasives, n.e.s.:				
Natural crude _ _ _ _ _ _ _ _ _ _ value _ _	$126,000	$17,000	$15,000	Italy $2,000.
Artificial corundum _ _ _ _ _ _ _ _ _ _ _	800	647	_ _	Czechoslovakia 385; Poland 153; United Kingdom 81.
Dust and powder of precious and semiprecious stones _ _ _ _ _ value _ _	$54,000	$61,000	$18,000	Netherlands $25,000; Switzerland $14,000.
Grinding and polishing wheels and stones _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	260	207	3	West Germany 92; Czechoslovakia 27; Italy 25.
Asbestos, crude _ _ _ _ _ _ _ _ _ _ _ _ _ _	17,105	10,247	200	U.S.S.R. 5,108; Canada 1,328; Austria 294.
Boron materials: Boric acid and oxide _ _	1	NA	_ _	All from Netherlands.
Cement _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	407	_ _		
Chalk _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	236	125	_ _	All from France.
Clays and clay products:				
Crude _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	864	2,069	_ _	Czechoslovakia 1,069; United Kingdom 801.
Products: Refractory including nonclay brick _ _ _ _ _ _ _ _ _ _ _ _ _	20,995	21,663	836	Austria 10,219; West Germany 6,845; France 1,999.
Cryolite and chiolite, natural _ _ _ _ _ _	5	57	_ _	Denmark 45; United Kingdom 11.
Diamond, industrial _ _ _ _ _ _ _ _ value _ _	$171,000	$85,000	_ _	United Kingdom $76,000; West Germany $9,000.
Diatomite and other infusorial earth _ _ _	204	84	81	Italy 2.
Feldspar and fluorspar _ _ _ _ _ _ _ _ _ _	195	70	_ _	Canada 40; Sweden 20; West Germany 10.
Fertilizer materials:				
Crude:				
Nitrogenous _ _ _ _ _ _ _ _ _ _ _ _ _	10,213	18,313	7,968	Romania 5,044; Italy 2,940; Netherlands 2,223.
Phosphatic _ _ _ _ _ _ _ _ _ _ _ _ _ _	591,482	513,122	_ _	Morocco 254,971; Tunisia 100,994; Israel 83,154.
Manufactured:				
Nitrogenous _ _ _ _ _ _ _ _ _ _ _ _ _	884,982	979,788	56,912	Italy 221,125; Romania 187,751; U.S.S.R. 104,943.
Phosphatic _ _ _ _ _ _ _ _ _ _ _ _ _ _	89,553	179,164	17,754	Romania 95,948; France 32,775; Lebanon 13,194.
Potassic _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	4,163	33,058	_ _	France 22,872; Italy 10,183; West Germany 2.
Other including mixed _ _ _ _ _ _ _	768,757	888,928	210,446	Republic of Korea 240,936; Switzerland 136,654.
Ammonia _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	127,832	156,122	132,054	U.S.S.R. 11,532; Kuwait 7,534; France 5,000.
Graphite:				
Natural _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	415	169	_ _	West Germany 148; Norway 16.
Artificial _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	104	134	_ _	West Germany 124; France 5.
Gypsum _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	_ _	7	_ _	All from United Kingdom.
Magnesite _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	2	2	_ _	All from West Germany.
Mica:				
Crude including splittings and waste _	52	45	_ _	West Germany 30; Republic of South Africa 15.
Worked including agglomerated splittings _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	_ _	33	_ _	Spain 19; India 9; France 2.

See footnotes at end of table.

Table 3.—Turkey: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Pigments, mineral:				
Natural, crude	5	--	--	
Iron oxides, processed	344	297	--	West Germany 285; Italy 7; United Kingdom 5.
Precious and semiprecious stones excluding diamond value	$39,000	$20,000	--	East Germany $15,000; West Germany $2,000; Switzerland $2,000.
Pyrite, gross weight	116	--	--	
Salt	132,293	50,015	--	Egypt 50,000; West Germany 15.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	10,996	32,379	421	Romania 12,329; West Germany 6,332; Italy 5,810.
Caustic potash	718	975	--	Italy 674; Bulgaria 110; Hungary 72.
Soda ash	16,287	43,544	--	Bulgaria 38,766; Romania 4,554.
Stone, sand and gravel:				
Dimension stone, crude	--	49	--	All from United Kingdom.
Gravel and crushed rock	100	--	--	
Quartz and quartzite	97	102	--	Sweden 50; West Germany 39; Switzerland 10; Austria 3.
Sand excluding metal-bearing	1	2	--	All from Belgium-Luxembourg.
Sulfur:				
Elemental	61,200	52,759	12,201	Kuwait 18,742; Iraq 10,000.
Sulfur dioxide	172	--	--	
Sulfuric acid, oleum	244,466	240,920	--	Switzerland 225,440; West Germany 15,448; Italy 32.
Talc and natural steatite	189	235	--	West Germany 165; Italy 70.
Other:				
Crude	1,292	784	--	United Kingdom 319; West Germany 149; Hungary 100.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	116	138	11	Italy 47; West Germany 38; Sweden 19.
Halogens	52	1,032	--	Italy 1,030; Netherlands 2.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	12	476	--	West Germany 355; France 121.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4	1,612	10	Albania 1,602.
Carbon black	4,338	8,503	12	West Germany 3,519; Italy 1,812; United Kingdom 1,527.
Coal, anthracite and bituminous including briquets	636,454	549,694	549,694	
Coke and semicoke	7,853	44,074	34,574	West Germany 7,000; Italy 2,500.
Hydrogen, helium, rare gases value	$49,000	$120,000	--	West Germany $51,000; Netherlands $39,000; Belgium-Luxembourg $19,000.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	79,747	53,660	--	Iraq 31,000; Libya 12,735; Iran 8,075.
Refinery products:				
Gasoline do	1,851	611	--	Italy 359; Romania 252.
Kerosine and white spirit do	(1)	5	(1)	Israel 4.
Distillate fuel oil do	11,294	13,695	182	Romania 4,469; Italy 3,079; Israel 1,374.
Residual fuel oil do	4,658	15,213	--	Italy 6,483; Iran 2,297; Greece 1,386.
Lubricants do	184	409	154	Romania 191; West Germany 39.
Other:				
Liquefied petroleum gas value, thousands	$55,759	$51,323	--	Kuwait $31,919; Saudi Arabia $14,079; Venezuela $2,502.
Mineral jelly and wax thousand 42-gallon barrels	50	22	(1)	West Germany 9; Hungary 5.
Unspecified do	88	130	53	Albania 74; Belgium-Luxembourg 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,446	38,401	37,882	Belgium-Luxembourg 477; Switzerland 30; West Germany 12.

NA Not available.
[1]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Disruptions in fuel supply and bauxite shipments kept the Seydisehir Aluminum Complex operating at half capacity for the third consecutive year. Bauxite for the complex was mined at Etibank's Seydisehir Mortas Mine, where reserves were estimated at 13 million tons with an Al_2O_3-SiO_2 ratio of 6.77. Some bauxite was also mined in western Anatolia, on the Aegean coast, near Mugla. Total throughput capacity of the integrated Seydisehir works was 460,000 tons per year of bauxite (boehmite and gibbsite) to produce 200,000 tons per year of alumina and 60,000 tons per year of aluminum. A fourth potline was to be put into production in 1981, increasing alumina production to 400,000 tons per year and aluminum production to about 120,000 tons per year. The Soviet Union, who provided the technology for the original plant, was considering funding the expansion project.

From 1977 to 1980 shortages of fuel had curtailed bauxite shipments, and production was held to about 30,000 tons per year of aluminum. Etibank announced in April 1980 that production was to reach full capacity by June because of increasingly available energy, but the fuel supply bottlenecks continued and production remained low throughout the year.

Antimony.—Antimony was produced principally by Ozdemir Antimuan Madenleri Ltd. Sti., at Tokat in central Anatolia. The mine produced 43,000 tons of ore, about 60% of capacity, to produce 2,000 tons of concentrate (65% antimony and 0.57% arsenic). Total reserves at Tokat were estimated at 350,000 tons containing about 12% to 13% antimony ore.

Other small antimony producers were Usak Mermer Sanayi ve Madencilik A.S., which produced about 1,000 tons of ore from its mine located in Kutahya Province, and Ahmet UZ, which operated a small mine in the Balikesir area. Reserves at Balikesir were estimated at 300,000 tons of ore containing 5% to 6% antimony. Etibank's plans to build a 2,600-ton-per-year antimony smelter at Balikesir were postponed owing to monetary shortages. The Italian firm, Tectomin, was to construct the facility, but Etibank lacked the necessary financing.

Chromite.—Turkey slipped to the fifth position in world chromite output, behind South Africa, the Soviet Union, the Philippines, and Zimbabwe. Chromite deposits occur in 40 of the country's 67 Provinces, along two major ore-bearing belts. Ore was mined by open pit, small-scale underground, and large-scale underground methods, depending on the type of deposit.

By far the largest producer of chrome ore was Etibank, which was responsible for approximately one-half of the country's output. Etibank mined chromite from the Guleman area near Elazig, from the Uckopru region near Mugla, and also near Bursa. Total capacity of Etibank's mining operations were around 300,000 tons per year of ore. Etibank operated three concentrators to process the ore. The Karagedik concentrator was located in Mugla, and the Sori and Kefdag concentrators were located near Elazig. The Karagedik concentrator had an annual capacity of 50,000 tons of ore and the Sori concentrator had an annual capacity of 30,000 tons; both of which produced 44% to 48% Cr_2O_3. The Kefdag concentrator treated low-grade disseminated ores from the Mount Kef region, and the maximum concentrate grade was 42% Cr_2O_3.

Ferrochrome.—Etibank also produced both high- and low-carbon ferrochrome from its two plants in Antalya and Elazig. At the Antalya Ferrochrome Works, approximately 10,000 tons of low-carbon ferrochrome ore was produced annually. Approximately 5,000 tons per year of ferrosilicon was also to be produced at Antalya in the near future. Etibank's Elazig Ferrochrome Works produced around 22,000 tons of high-carbon ferrochrome in 1980. The Elazig works was scheduled to add two additional electric furnaces to raise capacity from 50,000 tons per year to 100,000 tons per year, but installation was delayed until the plant reached current capacity.

In addition to Etibank, chromite ore was mined by several private Turkish operators, and also two foreign-owned companies. Turk Maadin Sirketi, owned by Metallurg of New York, operated mines in Denizli and Eskisehir with an annual capacity of 75,000 tons of chromite. Egemetal Madencilik A.S., an associate company of Metallgesellschaft (Federal Republic of Germany), was also an important producer of chrome ore. Egemetal also acted as a clearinghouse for the many small producers in the country. Met-

allgesellschaft handled the overseas sales for Egemetal.

Copper.—Production of blister and refined copper remained low in 1980, owing mostly to operating inefficiency and technical problems. Copper was produced mainly by two companies, Etibank and Karadeniz Bakir Isletmeleri (KBI), which is owned 49% by Etibank. Both companies operated mining, milling, or smelting facilities at the three major mining districts: Murgul, Ergani, and Kure.

At Murgul, Etibank operated one open pit mine with an annual capacity of 1 million tons of ore and KBI operated two open pits, with a combined capacity of 1.8 million tons per year. About 1 million tons of ore was mined from KBI's pits in 1980. Reserves at Murgul were estimated at 150 million tons. Both Etibank and KBI operated concentrators at Murgul, where the ore was upgraded to 18% copper. In 1980, the Etibank concentrator produced 200,000 tons of copper concentrates and KBI produced 60,000 tons. Etibank operated the only smelter at Murgul, with a 12,000-ton-per-year blister copper capacity, which produced around 500 tons of 90% copper in 1980. Modernization efforts were underway in 1980 at the smelter to increase production. Associated pyrite ore from Murgul was trucked to Hopa, about 60 kilometers north, where the pyrite ore was concentrated.

Etibank also operated a mine-mill-smelter complex at Ergani in eastern Turkey. Annual production capacity of the Ergani smelter was 16,000 tons of blister copper from 70,000 tons of 14% copper concentrates and 1 million tons of ore. Etibank was also modernizing the Ergani smelter, which was to increase production by 1982. Total reserves at Ergani were estimated at 1 million tons.

In the Kure District in northern Turkey, both Etibank and KBI operated mines. Etibank's Kure Cuprous Pyrite Works consisted of a 1-million-ton-per-year open pit mine and concentrator. KBI, at its Black Sea Copper Works, operated an underground mine, a concentrator, and a smelter located at Samsun, with a total capacity of 40,000 tons per year of blister copper. The KBI smelter continued to operate at about 20% to 40% of capacity, owing to mechanical problems and the difficulty in obtaining spare parts. The Samsun smelter came onstream in 1977, and has never reached its designed capacity.

Turkey continued to examine the possibility of developing the Rize-Cayeli copper deposit in northwestern Turkey, also on the Black Sea coast. Reserves at Cayeli were a confirmed 34 million tons of ore and another 200 million tons of probable reserves. Etibank owned the concession, but the mine was to be operated by Fenni-Gamma Inc., the former Turkish private owner. Fenni-Gamma was, in 1980, seeking a foreign partner to initiate development. The U.S. Agency for International Development was also considering providing some financing.

Iron Ore.—Despite planned increases in output, Turkey remained a large importer of iron and steel. The state-owned Turkish Iron and Steel Works (Turkiye Demir ve Celik Isletmeleri) supplied most of Turkey's iron ore output, from the Divrigi Mine, located in Sivas-Malataya Province. Total capacity at Divrigi was 2.8 million tons per year of 52% to 58% iron. Other iron ore mines that were nationalized in 1978 were to be returned to their former private owners in an attempt to increase iron ore production, which dropped 35% after nationalization. Despite plans to increase capacity at Divrigi to 5.2 million tons per year, output remained at under 2 million tons.

The Government continued to study the development of the Hasancelebi iron ore deposit, located southwest of Divrigi. Hasancelebi possessed large reserves (300 million tons) of relatively low-grade (15% to 30%) magnetite ore. The ore grade was too low for direct charging, and would require substantial concentrating before conversion into sinter or pellet feed. No development plans were made for the deposit in 1980, owing to a lack of development capital and the questionable economic benefit of the project.

Iron and Steel.—The Turkish Government owned or participated in all three of Turkey's operating steel mills, at Karabuk, Iskenderen, and Eregli. Crude steel production for the year totaled around 2 million tons, which was down slightly from the 1979 level, and was far below the targeted output. The shortage of locally available iron ore, the lack of foreign exchange for imported iron ore and coking coal, and insufficient production of electricity to keep the mills operating all contributed to the low productivity of the plants.

The state-owned Turkish Iron and Steel Works (Turkiye Demir ve Celik Isletmeleri) operated two steel plants; in Karabuk, 175 kilometers north of Ankara, and Iskenderun, on the Mediterranean coast near the

Syrian border. Production capacity at Karabuk was 600,000 tons per year of crude steel. Karabuk received imported iron ore and coking coal from the U.S.S.R. The plant at Iskenderun continued to experience major operating problems. The work force at the plant, originally intended to be about 10,000 people, mushroomed to over 18,000 as the plant managers, under Government pressure, attempted to alleviate some of the local unemployment and in turn win support for the Government. The plant has not operated above 25% of its design capacity since it opened. The Soviet-built plant utilized domestic iron ore, but imported most of its coke. Design capacity of the plant was 1 million tons per year of raw steel. The plant was expected to run at a loss of about $30 million in 1980.

The sole example of high productivity and operating efficiency in the industry was the Eregli Iron and Steel Works Association. (Eregli Demir ve Celik Febrikalari T.A.S.), which was owned partly by the Government and partly by private shareholders. Initial capacity at the steelworks was 800,000 tons per year when it opened. In 1973, a contract was awarded to Nippon Kokan of Japan to expand capacity to 1.8 million tons per year through the addition of a new blast furnace. The furnace began operation in 1977, and by 1980 output had reached 3,000 tons per day, exceeding its design capacity and setting a Middle East production record. The Eregli works utilized iron ore from Divrigi as well as domestically produced coal and coke. To further expand its output, Eregli ordered a second single-strand slab caster in March 1980.

Plans to build Turkey's fourth integrated steelworks were postponed owing to problems existing at the plants already in operation. The Turkish Iron and Steelworks Inc. originally planned to build another plant located at Sivas in eastern Anatolia. The $1 billion complex was to produce 1.8 million tons of steel annually, utilizing domestic iron ore and coal. Izmir Metalurji Fabrikasi T.A.S., a privately owned company in Izmir, also planned to construct a direct-reduction steel mill 12 miles east of Izmir, with a total capacity of 600,000 tons per year. Insufficient quantities of high-grade ore, as well as the high-capital costs of direct-reduction technology curtailed these plans as well.

Lead-Zinc.—Etibank and Cinko-Kursun Metal Sanayii A.S. (CINKUR) were responsible for most of the lead-zinc ore and refined metal produced in Turkey. At Etibank's Keban Lead and Zinc Works, approximately 40,000 tons of ore was mined, containing an average of 4% lead and 4.5% zinc. Both lead and zinc concentrates were produced, with output averaging 3,000 tons of 50% zinc and 41% lead.

CINKUR, owned 47% by Etibank, mined lead-zinc ores from the Zamanti Mine where reserves were estimated at 3.5 million tons of high-grade lead-zinc ore. The CINKUR smelter, which was completed in 1976, processed around 80,000 tons of ore in the production of 3,600 tons of lead, 8,000 tons of zinc, and a small amount of silver.

Other producers of lead and zinc ore were Beril Maden ve Sanayi Ltd. Sti. from mines in the Nigde-Kayseri region, M. Kemal Dedeman, also in the Nigde Kayseri area, and Menka Sanayi ve Ticaret A.S. from Sivas.

Mercury.—The production of mercury is one of Turkey's oldest industries. Cinnabar ore has been mined from three main areas (Konya, Karaburun, and Aydin) for nearly 8,000 years. Production has declined steadily from a high of over 10,000 76-pound flasks in 1971 to an average of 5,000 flasks per year, owing mostly to declining world demand. Many occurrences of mercury have been reported, with considerable reserves, mostly in western and central Anatolia. MTA, the Mineral Research and Exploration Institute of Turkey, reported that mercury production could be greatly expanded should world demand increase.

Etibank was the only producer of mercury in 1980, from its two smelters at Halikoy, near the Aydin mines, and in Konya. The Halikoy smelter could produce 120 tons per year of 99% pure mercury, while capacity at the Konya smelter was 100 tons per year. Some of the smelting facilities at Halikoy were converted to antimony production in 1978 because of the low demand for mercury.

Tungsten.—Etibank's Uludag tungsten mine began operating in 1977, after nearly 25 years of planning, development, and problems. The mine is situated near the summit of Uludag Mountain, in eastern Bursa Province, 42 kilometers from the town of Bursa. The deposit was discovered in 1950 by Maden Tetkik ve Arama Enstitusu (MTA), who had carried out the exploration, feasibility studies, and a preliminary plan for production by 1954. In 1961, Etibank took over all rights to the ore body, while MTA continued to evaluate possible

mineral dressing techniques. The decision to go ahead with the project was made in 1968, and underground development work was begun. Austro Mineral (Austria) was contracted to prepare a development plan for the mine, and Salzgitter Industriebau GmbH of the Federal Republic of Germany was contracted for process designing of the concentration plant. A consulting firm, Bergbau Sachtleben of the Federal Republic of Germany was called in 1977 when problems were encountered during commissioning of the mine and concentrator. Since 1978, Etibank has carried out all work under short-term supervision by United Nations experts.

The ore at Uludag consists of both granitic and skarn types. The granitic ore contains wolframite, while the skarn ore contains scheelite. The scheelite is mostly in finely disseminated form.

The Uludag deposit contains 9.4 million tons of proven reserves, and another 4.9 million tons of probable reserves. The average estimated grade of ore is 0.5% WO_3. The ore is extracted by both underground and open pit mining, although the open pit is closed from fall to late spring because of severe winter snowfalls. Total ore production in 1980 was nearly 290,000 tons, 190,000 tons of which came from underground. Underground mining techniques switched from long-wall stoping to sublevel stoping, with the ore being broken out by ring drilling and blasting. At the open pit, visible reserves were about 2.1 million tons, with a stripping ratio of 1 cubic meter per ton of ore. All open pit mining was carried out by private firms under seasonal contracts, but Etibank planned to take over all production in the near future.

The concentrator at Uludag was designed to treat 550,000 tons per year of both granitic and skarn ores. Originally two separate processes for concentration were envisioned for the two types of ore, but because of equipment failure, the skarn ores' dry grinding and magnetic separators have not come into operation. Both types of ore were wet ground, using the granitic separator at 30% over its capacity for both types. Various grades of concentrate are achieved, ranging from 20% to over 50% WO_3. In 1980, a flotation scheme to complement the current processing technique was being tested, which was to provide a 60% WO_3 concentrate in the near future.

Etibank also planned to replace timbering in the mine with roof bolting and renew the underground haulage network by 1981. Plans for the mill included commissioning a new automated hydroclassifier by 1981, purchasing two high-capacity wet-magnetic separators, installing a tertiary crusher, and recovering scheelite from the process slime by flotation by 1981.

NONMETALS

Asbestos.—Production of asbestos rose to approximately 16,000 tons, owing mainly to increased output from the 10,000-ton-per-year processing plant built by Amyant Sanayi A.S. in 1976. The company was the largest producer of asbestos in Turkey, operating a 30,000- to 40,000-ton-per-year tremolite deposit at Mihaliceik, near Eskisehir. Despite the higher level of production, Turkey was expected to import 5,000 to 10,000 tons of asbestos for domestic use. Approximately five other manufacturers were mining deposits in the country, mainly for their own use. All of the other deposits were of the amphibole type. Among the producers were Bilfer Maden Ltd. Sirketi (5,000 tons per year), Ozgur Atermit Sanayi ve Ticaret A.S., Sark Amyant Isletmeri, and Erton Bulgurlu Ithracat Ithalat ve Dahili Ticaret.

Barite.—The barite industry in Turkey has expanded rapidly since 1974, when the Government banned the export of raw barite, in an attempt to increase the export value by forcing producers to install grinding equipment. Grinding capacity increased by 500,000 tons per year in just over 5 years. Most of Turkey's ground barites were exported to the U.S.S.R., and some to Iraq, but with new capacity onstream in 1980, producers were searching for new Western and Middle Eastern markets. Turkey's barite producers were as follows:

Company	Location, mine(s), mill(s)	Mine capacity (tons per year)	Grinding capacity (tons per year)
Bastas Barytes Industry and Trading Co. Inc.	Alanya-Sarikaraagac, Trabzon, Antalya.	150,000	120,000
Barit Maden Turk A.S	Marash, Adana	50,000	70,000
Polbar Baryte Industries A.S	Alanya	40,000	50,000
Baser Maden Sanayii ve Ticaret A.S	Sarikaraagac	60,000	80,000
Kimya Tesisleri Sanayi ve Ticaret A.S	Silifke-Kutahya, Yarimca-Kocaeli.	30,000	100,000
Emas Industrial Minerals A.S	Mas	60,000	60,000
Dolsan Dolgu Maddeleri Sanayi Kollektif Sirketi	Antalya, Eskisehir	40,000	10,000
Durmus Yaser ve Ogullari	Isparta, Izmir	10,000	10,000
Etibank	Beysehir	1,000	--
Kale Madencilik	Icel	1,000	--
Egemetal Madencilik	Mersin	1,000	--

Bastas Barytes Industry and Trading Co. was Turkey's largest producer of ground barite. Despite the large capacity of its mines in Alanya and Sarikaraagac, most of the raw material for its mill in Antalya was purchased from other producers. Bastas formerly ground barite for Polbar Baryte Industries until Polbar brought its own mill online in 1980.

Polbar also has part of its raw output ground by Kimya Tesisleri (Kimtes) in Istanbul. Baser Maden Sanayii ve Ticaret A.S. was in the process of installing an extension to its grinding plant in 1980 to produce 80,000 tons per year of micronized material down to 5 micrometers. Kimtes also recently completed an expansion project raising grinding capacity from 30,000 tons per year to 100,000 tons per year in 1979. Emas Industrial Minerals was another newcomer to the industry, opening its integrated mine and mill in 1978. Production remained low in 1980 because of electricity shortages. Emas planned to export most of its output to the Middle East. Other smaller producers, including Etibank, sold their mine output to the large grading companies. Etibank, however, planned to enter the industry by installing a grinding plant at Beysehir.

Boron.—In March 1979, the Government of Turkey issued a decree nationalizing all boron mines, as well as iron ore and lignite, in the country. Contrary to the Government's intentions of increasing output of the private mines, no boron was produced for 10 months following nationalization, and then only 20% of the amount of boron was produced as when the mines were in private hands. To rectify the production problem, the Government was considering returning the mines to their former private owners. Three of the four former operators were willing to accept the offer, but no action was taken by the Government during the year and boron output remained low.

Boron was mined by Etibank from three major deposits located in Bigadic, Kirka, and Emet, all in northwest Turkey. In Bigadic, Etibank operated a 150,000-ton-per-year open pit colemanite and ulexite mine. Some output of the mine was exported in raw form and the remainder was shipped to Etibank's Bandirma facility for processing. Etibank was in the process of constructing a 150,000-ton-per-year concentrator at Bigadic. No completion date was available. Reserves at Bigadic were estimated at 30 million tons containing 25% B_2O_3. In Emet, Etibank operated both underground and open cast mines. The colemanite ore was concentrated to obtain 40% to 47% B_2O_3 at the 500,000-ton-per-year Emet Colemanite Works.

At Kirka, Etibank took control of an integrated tincal mining and processing operation. The Kirka Mine had a total capacity of 400,000 tons per year of tincal, most of which was trucked to Bandirma for processing. A chemical complex was completed at Kirka in 1980, but low output of the mine delayed startup of the plant. The complex was designed to produce 180,000 tons per year of crude borax pentahydrate, 60,000 tons per year of refined anhydrous borax, and 6,000 tons per year of refined borax decahydrate.

Etibank's Bandirma borax and acid plant was opened in 1969 to refine borax from the Emet mines. In 1980, ores from Kirka, Emet, and Bigadic were processed at Bandirma, located on the Sea of Marmara in northwest Turkey. Annual capacity of the complex was 55,000 tons of borax decahydrate, 25,000 tons of boric acid, 20,000 tons of sodium perborate, 120,000 tons of sulfuric acid, and 55,000 tons of borax pentahydrate (if required). Etibank was in the process of

expanding the facility through the addition of a 100,000-ton-per-year boric acid plant and a 100,000-ton-per-year borax plant to be completed in 1982, and a 20,000-ton-per-year hydrogen peroxide plant to be completed in 1985.

Cement.—The capacity of the Turkish cement industry was nearly 20 million tons per year in 1980, while demand stood at approximately 12 million tons annually. Exports of cement were hindered by inadequate loading facilities at Turkish ports, and noncompetitive prices set by the Ministry of Trade. Actual production of cement in 1980 was 14 million tons, reflecting lower productivity caused by the shortage of fuel oil and electricity. Lower production was accompanied, however, by a general slackening in demand, thus maintaining a small surplus available for export.

Contracts for expanding cement production capacity were awarded to Fuller Co. (United States) by Cankkale Cimento Sanayii T.A.S. of Istanbul to raise capacity to 5,000 tons per day, and to KHD Industrieanlagen of the Federal Republic of Germany for construction of seven 1,750-metric-ton-per-day cement plants. The seven new plants were ordered by the state-owned Turkiye Cimento Sanayii T.A.S., which already owned and operated 15 of the country's 34 cement plants. Most of the units and raw materials for the plants were to be provided by Turkish companies, with only the main structural elements being imported from the Federal Republic of Germany.

Emery.—Turkey produced approximately 80% of the world's output of fine-grained emery. Etibank was the major producer, from its Milas Mine in western Anatolia. Production capacity at the mine was 30,000 tons per year of raw emery. The only other producer of any significance was L. Kitapci Mineral Co. Ltd., which operated several small mines in the Mugla area. Most of Turkey's emery was exported in raw form, for use in abrasives. Very little processing was carried out in the country. Only about 20 to 25 tons of emery powder and 10,000 tons of abrasives were exported, compared with approximately 25,000 tons of run-of-mine exported in 1980. Most of the output was exported to France, the United Kingdom, the Netherlands, and the Federal Republic of Germany.

Fertilizer Materials.—Production capacity of Turkey's fertilizer industry increased approximately 12% in 1980, through the addition of several units at the Bandirma fertilizer complex. Other planned expansions of the industry were tentatively shelved owing to the shortage of foreign currency to purchase equipment. Turkey produced approximately 7.6 million tons of fertilizers in 1980, well below the nearly 10 million tons required in the country. Most of Turkey's fertilizer plants operated at or below 60% of their capacity.

Despite the increases in overall capacity, production of fertilizers remained low, especially for phosphate fertilizers. At Bandirma, Bandirma Gubre Fabrikalari (Bagfas) operated a triple superphosphate plant, which was built in 1973. The plant originally produced single superphosphate from sulfuric acid, but was later converted to produce triple superphosphate from phosphoric acid. Two additional plants were added to the complex late in 1979 and in March 1980. The first was a 495,000-ton-per-year sulfuric acid unit and the second was a 40,000-ton-per-year nitrogen ammonium sulfate plant. Three additional units were to be commissioned by 1981. These were: A 145,000-ton-per-year phosphoric acid unit, a 15,000-ton-per-year diammonium phosphate plant, and a 150,000-ton-per-year complex fertilizer unit. Uhde of the Federal Republic of Germany was responsible for construction of the project, except for the sulfuric acid plant, which was constructed by Polimex-Cekop of Poland. The fertilizer unit was to be operated by Bagfas, while the acid units were to be operated by Isci Isadami Kimya Sanayii Kuruluslari (Iskur). Included in the expansion project were additional fertilizer loading and unloading facilities.

Phosphate.—Despite Turkey's large reserves of middle- to low-grade phosphate rock, the country continued to import over one-half million tons of phosphate rock per year, making it the country's largest mineral import. Turkey spent over $28 million on imports of phosphate in 1980.

Etibank was the only producer of phosphate rock from the southern Anatolian Phosphate Project at Mardin in southeast Turkey. Operating capacity at the Mazidag deposit was 250,000 tons per year of phosphate rock. Etibank contracted Beker Industries (United States) in 1978 to aid in developing the deposit, which has operated at only about 10% of rated capacity for the past 2 years. Total reserves at Mazidag were estimated at 410 million tons of phosphate rock, containing 10% to 25% P_2O_5.

Sulfur.—Etibank was a direct producer of sulfur from its underground and opencast

mine at the Keciborlu Works, where production capacity was 20,000 tons per year of pure sulfur. The rest of the country's sulfur output came from fertilizer plants and sulfide ores used for manufacturing copper, from which a pyrite concentrate was obtained. All of the concentrate was consumed in acid production. Acid production from the country's copper works and fertilizer plants was 495,000 tons per year of sulfuric acid from the new plant at Bandirma, 365,000 tons per year of technical-grade acid from the Black Sea Copper Works, and a small amount of acid from the Ergani Copper Plant. Pyrite ores from Murgul were trucked to Hopa where they were concentrated. About 20,000 tons per year of pyrite was concentrated at Hopa in 1980.

Magnesite.—Turkey produced approximately 500,000 tons of magnesite in 1980, 90% of which came from four major producers operating in the Kutahya, Eskisehir, and Konya Districts. The magnesite industry has experienced major problems in recent years, mainly caused by lack of financing, poor conditions in the world market, and labor problems. Labor unrest forced one magnesite plant to close late in 1979.

Dead-burned magnesite was produced by Kutahya Manyezit Isletmeleri A.S. (Kumas), Manyezite A.S., and Sumerbank. Kumas was by far the largest producer operating three deposits in Kutahya, with a total capacity of 250,000 tons per year, and a calcining plant, also in Kutahya, with a 180,000-ton-per-year capacity. Kumas was considering building a brick manufacturing plant at Kutahya, instead of selling some of its output to the brick plant operated by Sumerbank at Konya.

Manyezit A.S. also operated its mines in the Kutahya-Eskisehir region. Production capacity of the Manyezit Mine was 120,000 tons per year of crude ore and 60,000 tons per year of calcined magnesite. The company was originally a subsidiary of Veitscher (Austria), but was in the process of changing ownership, possibly to Continental Madencilik Sanayi ve Ticaret A.S. (Comag), or the Government.

Sumerbank, the last major producer of dead-burned magnesite, was also the only producer of refractory bricks. The sinter magnesite capacity of the plant, located in Konya, was 40,000 tons per year. Brick capacity was 26,000 tons per year. Magnesite ore from the Konya area was generally of lower quality and higher in silica and lime content than ore from the Kutahya-Eskisehir District. Sumerbank supplemented its mining operation with high-grade ore produced by Kumas.

Comag was the country's largest producer of caustic calcined magnesite. Magnesite ore was mined in two areas, Tavsanli and Kumbet, and calcining plants were located adjacent to both mines. The plant at Tavsanli was operating at about one-third of its capacity, while the Kumbet plant operated quite profitably in 1980. Raw material for the Kumbet plant was high-grade magnesite, very low in silica and iron. Output of the calcining plant was suitable for use in electrofused magnesia products, the price for which was nearly double that of agricultural-grade products.

Other producers of magnesite in Turkey were Bozuyuk Kimya Sanayi in Eskisehir, Ismail Sahin and Koycegiz Kromlari Isletmeri A.S., also in Eskisehir, and Mittas Metalurji Ticaret A.S. in Erzurum. Output from the other producers was below 40,000 tons of ore per year.

Perlite.—Perlite production rose 15% in 1980 as a result of increasing world demand. Several mines were operating in the country, with the two major operations located in Cumaovasi, Izmir. Etibank developed the integrated Cumaovasi Mine and processing plant in 1975. Annual production capacity from the operation was 140,000 tons of processed perlite and 50,000 to 60,000 cubic meters of expanded perlite. Raw material for the Etibank grinding and processing plant was supplied by two mines, one several hundred meters from the plant, reserves at which were 4.5 million tons proven and another 5.6 million tons probable. Raw material was also available from the Minassa deposit, several kilometers away. Perlite from Minassa had significantly better expansion characteristics than the perlite from the plant area. Reserves at Minassa were estimated at about 7 million tons, of which 2.5 million tons were proven.

The other major producer of perlite in Turkey was Zihni International Trade and Marketing, whose mine was also located in Izmir. Annual production capacity of the mine was 50,000 tons. The company was considering setting up a grinding plant with a capacity of 75,000 to 100,000 tons per year. Other smaller perlite producers were Izmir Perlit Madencilik Ltd. Sti. at Bergama (3,000 tons per year) and Pabalk Ticaret ve Perlit Sanayi A.S. near Istanbul.

MINERAL FUELS

Total electric power generating capacity in Turkey in 1980 was 4,600 megawatt hours. Of the total electricity produced, approximately 45% is from hydroelectric plants, with the remaining 55% from thermal generating stations. Approximately 34% of electricity produced by thermal plants was from oil-fired furnaces, and 66% was from coal; mostly lignite and a small amount of hard coal. Annual increases in demand for electricity have averaged 500 to 600 megawatts. Because of the difficulty in expanding coal mining operations, the lack of foreign currency to purchase new coal-fired thermal stations, and the antiquated nature of the coal transportation network, increases in electricity demand have been met almost solely by increasing imports of oil, for which the Turkish economy has paid a stiff price. Because of the oil import bill and the rising demand for electricity, energy projects were receiving top priority by the new Government of Turkey. The emphasis was placed on expanding coal production and increasing the capacity of coal-generated electricity.

Coal.—Turkey has pinned most of its hopes for energy independence on coal and lignite. The state-owned Turkish Coal Authority (TKI) was the sole producer of hard coal, and also produced from 70% to 80% of all lignite. TKI operates in conjunction with the Turkish Electricity Authority (TEK) who installs the thermal power stations in lignite mining areas. Despite the emphasis on coal production and coal-fired power stations, most coal mines operated below capacity, owing mostly to bottlenecks in transporting coal from the mining areas to the power stations. Even with its ample reserves of both hard coal and lignite, Turkey imported around 20% of its total domestic requirements.

Hard coal was produced by TKI from the Zonguldak District. Annual production was about 4 million tons per year from several mines, including Kandili, Kozlu, Uzulmez, and Gelik. The mines were operated by Ergeli Komuleri Isletmeri under the authority of TKI. Production of privately held mines in the same area accounted for less than 1% of total hard coal production. Reserves of hard coal in the country were estimated at 1.2 billion tons. Turkey still had to import metallurgical coal for use in the Iskenderun and Eregli steel mills.

In October 1978, the Turkish Government nationalized nearly all lignite mines in the country in an attempt to increase their productivity. With production under the authority of TKI, annual lignite output declined over 30%, owing to poor management of the mines, labor disputes, and a shortage of diesel oil to run the machinery. Production in 1980 rebounded somewhat, but remained below the annual output from when the mines were privately owned.

Lignite was produced in several areas around the country. Major mines were located in Tunebilek, Soma, Beypazari, and Seyitomer. Production capacity at all of TKI's lignite operations was nearly 20 million tons per year. Production or transportation problems existed at nearly every location, holding production to around 60% of total capacity. Total lignite reserves in the country were estimated at about 6 billion tons.

TKI planned expansion projects for several of the major lignite mines. Production capacity at Beypazari was to be upgraded to 3 million tons per year at a cost of over $85 million. Production at Tunebilek was to reach 2 million tons per year by 1981 at a cost of about $24 million. The mines at Seyitomer were to increase capacity to 1.2 million tons per year also by 1981 for about $18 million. The mines at Soma were also scheduled to undergo expansion to produce 7.8 million tons per year of lignite in two separate projects, Soma-Isiklar and Soma-Denis. The Soma-Isiklar project was to be integrated with a thermal power station. The project was scheduled for completion in 1981.

By far the largest and most ambitious project in TKI's expansion program was for the Afsin-Elbistan region, where construction had already begun on an integrated 20-million-ton-per-year lignite mining operation and a 2,400-megawatt thermal power station. The powerplant was to be the largest lignite-fueled powerplant in the world. Construction began in 1977 on the power station, and in 1979, 4.2 million cubic meters of overburden were stripped off the coal deposit on which the plant sits. Reserves at Elbistan were estimated at around 2 billion tons of lignite. Cost of the project was estimated at over $3 billion, 60% of which required foreign financing. The first phase of the integrated operation was to come onstream sometime in 1982. The second phase of the project, still in the planning stage, was to produce another 20 million tons per year of lignite to fuel four addi-

tional generators. The first phase alone was to burn 60,000 tons of lignite per day, and employ over 6,000 people.

TKI and TEK planned to construct several other integrated coal mine power stations, although Afsin-Elbistan was preempting most of the investment funds. Other plants were planned for Bursa-Orhaneli, Bursa-Keles, Mugla-Yatagan, Sivas-Kangal, and Tekindag-Saray. Because of the economic situation in Turkey, the initiation of any new projects during the construction of the Afsin-Elbistan plant appeared unlikely.

Petroleum.—Turkey was one of the countries most seriously affected by the oil price increases in 1979. The Government spent more than its income from exports on imported oil, leaving little for manufactured goods and development projects. The annual oil import bill was expected to exceed $3 billion in 1980. Combined with the increasing price of imported oil, domestic crude oil production has been declining since 1969. The need to purchase imported oil and the resulting divergence of foreign currency away from the productive sectors has fueled runaway inflation and left the economy with serious difficulties. New exploration and production agreements with foreign firms may be able to reverse the decline in domestic production, but it is unlikely that the country's oil problem will disappear in the near future.

Production.—Domestic production of crude oil in Turkey was at its maximum in 1969, at about 70,000 barrels per day. It has declined unevenly since then to about 46,000 barrels per day in 1980. Production rose unexpectedly in 1979 to 56,000 barrels per day in response to the severe shortage during that year, but dropped again in 1980. The declining production was due to the fact that most of Turkey's wells were 10 to 20 years old and now facing water problems.

The major oil producer in Turkey was the state-owned Turkiye Petrolleri Anonim Ortakliki (TPAO), which produced approximately 35% of all crude oil in the country. N.V. Turkse Shell, a subsidiary of U.S. Shell, produced about the same amount, and Mobil Exploration Mediterranean Inc. (a Mobil Oil Corp. subsidiary) and Erson Petrol Sanayii both produced about 15% of the total. Domestic production accounted for about 14% of the country's petroleum requirements.

The International Bank for Reconstruction and Development (IBRD) (United States) was considering loaning Turkey $50 million for an enhanced secondary recovery program for the Bati Raman Oilfield. Bati Raman, located in southeastern Turkey near the Syrian-Iraq border, was the country's most productive field, producing slightly less than 10,000 barrels per day. Enhanced recovery programs at other fields were not expected to yield significant results until 1982 or later. Turkey's oil reserves were estimated at about 400 million barrels.

As part of the economic recovery program initiated in 1979, and endorsed by the military Government, new decree's were issued to encourage foreign investment in the oil sector and an Office of Foreign Investments was established in 1980 to promote these investments.

The new decrees abolished most of the disincentives of the 1973 decrees as well as promoting the use of foreign expertise, reopening processing industries to foreign companies, and permitting companies to export 35% of production and to use these proceeds for the repatriation of their capital and profit. The TPAO became entitled to enter joint ventures with foreign firms, and was permitted to accept international arbitration in its joint venture agreements. An exploration fund was also established for both state and private companies to facilitate oil exploration.

Exploration.—The new decrees have attracted some international attention. Shell, already operating in Turkey, picked up two additional exploration permits in the Agachan site in the Siverek District of Urfa. Other foreign firms to express an interest were Veba, of the Deminex group (Federal Republic of Germany), CFP Total (France), and three United States companies; Phillips 66, Occidential Petroleum, and Sunmark of California.

Under TPAO's own exploration program, approximately 75 test wells were drilled in 1980, 17 of which encountered hydrocarbons. Results of the tests were not conclusive enough to determine the size of additional reserves. TPAO made a potentially sizable discovery at Nusaybin, 20 kilometers from Camurlu, near the Syrian border. Initial estimates put the potential production from one well at 1,000 barrels per day. TPAO also encountered significant quantities of natural gas at Thrace. Initial production from the wells was 3 million cubic feet per day, which has since risen to 5.2 million cubic feet per day with six wells producing from the field. New discoveries were not

expected to have an impact on Turkey's domestic production until 1982.

Pipelines.—1980 was a difficult year for Turkey in terms of assured supplies of imported oil. Two of Turkey's major suppliers, Iran and Iraq, almost completely dried up in September 1980 at the start of the Iran-Iraq war. Turkey had just completed an agreement with Iran to purchase 60,000 barrels of oil per day, making Turkey Iran's fourth largest customer. Oil sales from Iraq, which were transited mainly through the Kirkuk to Yumurtalik (Botas) pipeline, were to reach 35 million barrels in 1980, only 24.5 million barrels of which had been delivered when the pipeline was bombed in September. Iraq and Turkey had also agreed to increase the capacity of the pipeline from 700,000 barrels per day to about 1 million barrels per day. Included in the agreement were plans to construct a joint refinery and petrochemical complex in Yumutalik, near Ceyhan, to build a natural gas pipeline to carry Iraqi natural gas to Turkey, and to build another pipeline from Yumurtalik to a projected 10,000-barrel-per-day oil refinery near Ankara. The war temporarily or permanently shelved most of these plans. Late in September, Turkey's oil stocks dwindled to below 1 month's supply.

In an effort to make up some of the shortfall caused by the war, several Persian Gulf nations agreed to increase their output and aid Turkey's supply situation. Turkey was in the process of negotiating a long-term contract with Saudi Arabia late in 1980. Turkey also concluded an agreement with the U.S.S.R. for delivery of an unspecified amount of oil. As Turkey's foreign exchange crunch eases and oil from Iraq resumes flowing through the pipeline, Turkey's chronic shortage of supplies is expected to improve.

Refining.—All four refineries in Turkey were owned by the state organization, TPAO. The Anandolu Tasfiyehanesi A.S. refinery, originally owned by Mobil Oil Corp. (United States), Royal Dutch/Shell (Netherlands), British Petroleum, and Marmara Refining, was nationalized because it was operating below capacity. TPAO, once in control, was unable to increase its output, the problem being a shortage of crude oil input. In April 1980, TPAO allowed Mobil to use the refinery for a nominal fee if Mobil would bring in the necessary crude oil to be paid for by the Government. The refinery was able to operate near capacity for the rest of the year. TPAO's other refineries, at Izmir, Batman, and Aliaga operated near capacity, with only temporary interruptions in crude oil supply.

The Istanbul Petrol Refineri A.S. (IPRAS) refinery at Izmir was owned 99% by TPAO, but operated autonomously from the state. Originally built by the California-Texas Petroleum Co. (United States), the refinery was the most efficient in the country. Expansion was underway at IPRAS to bring capacity to 250,000 barrels per day from the current 150,000 barrels per day. The lack of foreign exchange has delayed startup of the new capacity.

Turkey and Iraq signed an agreement in December 1980 to set up a joint venture refinery and petrochemical complex near the terminus of the Kirkuk-Yumurtalik pipeline. Whether Iraq plans to go ahead with the project despite its loss of output from the Iran-Iraq war was unclear.

Petrochemicals.—Turkey's petrochemical industry was founded in 1956 with the opening of the Batman refinery. A state-owned organization, Petkim Petrochemicals Corp. was formed in 1965 to operate Turkey's first petrochemical complex, which opened in Yarimca in 1970. Increasing demand for petrochemical products in the 1970's led to the decision to expand the Yarimca complex and establish a second plant at Aliaga. The state organization produced petrochemical raw materials that were used mostly by the private sector in producing semimanufactured items, such as synthetic fibers and chemical compounds.

The Yarimca plant, currently the only producer of raw petrochemicals in Turkey, was to complete its expansion program by 1982. The second petrochemical complex, at Aliaga, was under construction, and the estimated completion date was sometime in 1984. Most of the financing for the $1.5 billion Aliaga plant has been obtained, and contracts for construction of all units were signed.

Petkim was preparing to establish a third petrochemical complex, at Yumurtalik, in a joint venture with Iraq. The complex was to be located near the terminus of the Kirkuk-Yumurtalik pipeline, and operate on Iraqi crude oil or natural gas. The plant was to be composed of 19 units and was to cost an estimated $2 billion. No tenders were called for as of the end of 1980, and Iraq's participation in the project was called into question since the start of the war. The products and capacities of Turkey's petrochemical

plants are given in the following tabulations.

Petkim-Yarimca

Product	Current capacity (tons per year)	Expanded capacity (1982) (tons per year)
Ethylene	30,000	55,000
LD polyethylene	12,000	27,000
Vinyl chloride monomer (VCM)	27,000	54,000
Polyvinyl chloride	26,000	52,000
Styrene	25,000	25,000
Polystyrene	15,000	15,000
Chlor alkali	18,000	36,000
Carbon black	15,000	30,000
Dodecylbenzene	10,000	20,000
Coprolactum	25,000	25,000

Petkim-Aliaga (1984)

Product	Capacity (tons per year)
HD polyethylene	40,000
LD polyethylene	150,000
Polypropylene	60,000
Chlor alkali:	
Chlorine	65,000
Caustic soda	73,000
Vinyl chloride monomer (VCM)	105,000
Polyvinyl chloride (PVC)	100,000
Naphtha cracking:	
Ethylene	300,000
Propylene	150,000
C_4	80,000
Prolysis gasoline	215,000
Aromatics:	
Benzene	115,000
P-xylene	110,000
O-xylene	65,000
Pure terephthalic acid	70,000
Ethylene oxide	54,000
Ethylene glycol	68,000
Phthalic anhydride	30,000
Acrylonitrite	70,000

Uranium.—The findings of the uranium study conducted by the Woods Hole Oceanographic Institute and the Institute of Paleontology at Hamburg University were called into question by a subsequent investigation by MTA. The original study speculated that around 6.7 million tons of uranium oxide was present in deepwater basins in the Black Sea. The new study indicated that little uranium was present on the sea floor near the Turkish coast, but the uranium level increased slightly at depths of 2,000 meters or more. The estimated reserves on the sea floor were reduced to 2.2 million tons of ore. The study reported that uranium deposits on land in the eastern Black Sea region were more economic from an extraction and processing standpoint.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate TL47.1=US$1.00.

The Mineral Industry of the U.S.S.R.[1]

By V. V. Strishkov[2]

The U.S.S.R.'s completely nationalized economy maintained its position as the world's second largest producer of industrial products in 1980. In the Soviet Union, 1980 marked the end of the 10th 5-year plan for 1976-80. The following production increases, compared with that of 1979, have been reported in million tons: Oil (including condensate), 17.4; natural gas (billion cubic meters), 28.4; iron ore, 3.3; mineral fertilizers, 9.5 (Soviet standard); and cement, 2. Electric power output increased 57 billion kilowatt-hours. Output of many nonferrous, rare, and precious metals, oil refinery and petroleum products, and nonmetallic minerals was slightly higher than in 1979. Production of the following mineral commodities decreased, compared with that of 1979, in million tons: Raw coal, 2.7; crude steel, 1.0; and finished rolled ferrous metals, 0.2.

The U.S.S.R. is the leading world producer of iron ore, manganese ore, platinum-group metals, petroleum, steel, potassium salts, asbestos, and cement. The U.S.S.R. occupies second place, following the United States, in world output of aluminum, lead, natural gas, coal, and phosphate rock; it ranks second, after Canada, in the production of nickel and follows South Africa in gold and chromium ore output.

In 1980, official industrial production rose only 3.6% (4.5% planned), national income increased by 3.7% (4% planned), and the Soviet Union has confirmed that its economy had suffered its second worst year since World War II. Heavy industry grew 3.7% (4.5% planned) and consumer goods production rose 3.5% (4.5% planned). Industrial labor productivity grew only 2.6% (3.8% planned).

Soviet mineral production statistics released by the Central Statistical Administration ("Pravda," January 24, 1981) show that production goals contained in the 1976-80 5-year plan were not met. The revised goals for 1980, which were approved in December 1979, were also not met except for natural gas production. The 1980 annual plan was not fulfilled for the extraction of crude oil, coal, the production of pig iron, crude steel, finished ferrous rolled metals, iron ore, mineral fertilizers, cement, and many nonferrous and precious metals. The coal and ferrous industries enterprises not only failed to cope with the target but actually reduced their output in comparison with that of 1979.

On the whole, the Soviet mineral industry is lagging in respect to planned targets. Despite the fact the U.S.S.R. is the world's leading producer of steel, pig iron, mineral fertilizers, and cement, the mineral industry has failed to deliver to the economy its requirement of iron, steel, rolled metal, cement, mineral fertilizers, and other products. The shortage of metals and cement is holding back the development of allied industries, especially machine building and construction. This is because the performance of the Soviet industry is measured by units of gross production rather than units efficiently consumed in the economy.

Table 1 gives planned and reported figures for 1979 and 1980.

Table 1.—U.S.S.R.: Soviet industrial production

(Million tons)

Commodity	1979		1980		
			Planned		
	Planned	Reported	Originally (low-range)	Revised goal	Reported
Iron ore (usable)	NA	NA	276	NA	245
Pig iron	114	NA	NA	115	NA
Steel, raw	156	149	169	157	148
Coal, raw (bituminous, anthracite, lignite)	752	719	800	745	716
Crude oil (including condensate)	593	586	620	606	603
Natural gas (billion cubic meters)	404	407	400	435	435
Mineral fertilizers (Soviet standard)	111	95	143	115	104
Cement	NA	123	143	NA	125
Power, electric (billion kilowatt-hours)	1,265	1,239	1,340	1,295	1,295

NA Not available.

The U.S.S.R.'s reported mineral commodity consumption per capita approaches that of Western Europe, although there is still a significant difference in the living standards. One reason for the apparent difference is that the Soviet growth is measured in terms of energy and minerals produced, not in terms of energy and minerals usefully consumed. In addition, fuel and mineral shortages often bring with them substandard commodities that are marketed as standard items.

Although comparisons of minerals data between the Soviet Union and those of Western countries are often made, they are rarely valid unless qualified in great detail. The relative size or the relative growth of the Soviet mineral industry can be determined from a careful and exhaustive study of all pertinent Soviet publications. Soviet self-criticism, although sometimes reported in an obscure fashion, shows an acute awareness of their problems.

The central economic problem is the slowdown in the growth of industrial production. The economy grew at an annual rate of 6% in the 1950's, 5% in the 1960's, 3.5% by the mid-1970's, and probably will only grow by 2% to 2.5% in the 1980's.

Mineral Industry Labor.—With a total population of 266.6 million in January 1981 (a growth of 2.1 million in 1980), the Soviet economy employed 112.5 million industrial workers and 13.5 million farmers. In 1979, women accounted for more than 51% of the labor force. In the U.S.S.R., 9 out of every 10 women of working age (i.e. 16 to 55 years old) work in the Soviet economy. Only 1 woman out of 10 does not work, chiefly in families with many children, or cares for a very young child. The employment of both spouses is characteristic of the Soviet family. Until recently, women represented a major labor reserve but the main sources for labor force growth have been practically exhausted and the use of other CMEA[3] member nations' labor is growing in the Soviet Union. For example, Polish workers are constructing the Surgut-Polotsk oil pipeline, extending 153 kilometers, and Bulgarian workers are working on construction in the Turkmen S.S.R. The CMEA member countries are assisting in developing the Soviet mineral industry with a view toward obtaining crude oil, natural gas, metals, and other raw materials.

Practically all sectors of the mineral industry maintained a greater number of production personnel than called for by plan targets. This is done for a number of reasons, including unforeseen breakdowns in production, demands to send industrial workers to do agricultural work, and the transfer of workers to perform community service.

The Soviet ferrous and nonferrous industries employed over 3 million workers,[4] including 130,000 persons in the transportation sector of the nonferrous industry alone,[5] and the coal industry employed 2.2 million workers.[6] The oil, gas, and petrochemical industries employed 2.6 million workers, including over 250,000 in the development of oilfields and gasfields.[7] The crude oil extraction industry employed about 740,000 persons.[8] There were about 155,000 graduate mining engineers in the Soviet economy in 1980, who were trained at 38 Soviet institutes.

The work week in the U.S.S.R. is 41 hours for standard workers and 36 hours for underground miners. Soviet statistical agencies do not publish data on the actual earnings of mineral industry workers. The average official monthly earnings of all Soviet workers and employees in 1980 was

168.5 rubles[9] compared with 163.5 rubles in 1979, an increase of 3%. In 1980, the monthly minimum wage was 70 rubles.

Because of the falling increment of the able-bodied population, labor shortages have become a major problem for the Soviet economy. During the period 1981-90, the labor growth rate will not rise above 4% compared with 18% during the past 10 years. The main cause of this is the decline of the birth rate, as a result of remote consequences of World War II. More than 94% of the able-bodied population are already drawn into the economy. Nearly 2 million jobs are vacant in the economy of the U.S.S.R., with an economic demand growing by 0.8 million workers annually. However, it must also be stressed that in the early 1990's the situation in the labor resources will improve.

With the approval of the Soviet trade union, thousands of coal mines are being forced to work 7 days a week, including Sundays, while thousands more have to work double shifts during the week. The free days, usually Sundays, have been gradually made into workdays in some mines of the Donets Coal Basin. According to "Labor,"[10] throughout the Ministry of the Coal Industry of the Ukrainian S.S.R., the whole period from March to July 1980, inclusive, were working days. Despite this, 74 of the 92 mines of the Voroshilovgrad Oblast' did not fulfill their planned targets. The weekly repairs on the mines used to be done on Sundays, but mining on Sundays does not permit machinery to be kept in repair.

Government Policies and Programs.—Soviet mineral policy is predicated on the principle of maximum self-sufficiency at all costs. With state-owned and state-operated enterprises, low-wage labor, and low consumption, the U.S.S.R. has become the most self-sufficient of the world's leading industrial nations. In the Soviet economy, the price mechanism is set to yield desired results (often political) other than profitability; thus some mineral ventures in the Soviet Union might well be uneconomic by Western standards. Mineral development, as the basis of industrial growth, holds a key place in the Soviet economic policy. Very large sums are spent on mineral exploration and production, and the funds are distributed over a dozen specialized ministries.

Balance in the Soviet economy is achieved by Government intervention through subsidies, controls, and similar measures. The Soviet mineral economy has been a totally planned economy since 1929. Production goals are established at a very senior level and are approved by the Supreme Soviet of the U.S.S.R. One of the most striking contrasts between Soviet and Western mineral economies is the clear direction given to the development of Soviet mineral policy. In most market-orientated economies, national mineral policy is largely an accommodation of often divergent and conflicting sectors of the economy. In contrast, the Soviet Union's 5-year plan and year-to-year plans set a definite policy for all mineral commodities. In addition to expressing national priorities within which each industry must operate and individual industry goals, the plan is also law and carries mandatory obligations.

The measures for reorganizing the Soviet planning system approved by the CPSU Central Committee and the U.S.S.R. Council of Ministers on July 29, 1979, do not signify any basic reorientation of Soviet economic policy. A reorganization within the planning and bonus system is designed to promote the intensive factors in economic growth, particularly such matters as increases in productivity and expansion of contractual relations, which are simultaneously supposed to improve horizontal coordination within the economic process.

The current operating gross cost indices show the fulfillment of the plan in tonnage and rubles. Society is interested in the reduction of production costs, but the enterprises, seeking to fulfill their planned targets in gross tonnage and ruble value, find it more expedient and profitable to produce heavier and expensive products. For example, in 1980 certain metallurgical enterprises failed to deliver a substantial volume of valuable products to consumers. At the same time, they successfully fulfilled their plans for marketing. Until now the basic evaluation index has been gross production, but according to the new decree, results are to be evaluated by the index of net production. Soviet planners believe that the net output index will remove the incentive to use the more expensive raw materials and semifinished goods, thus decreasing the cost of an enterprise's gross output.

The new standard net output indicators (introduced in the reform decree of July 29, 1979) possess some advantages in comparison with quantitative indicators of production. However, the comparison is extremely

complex and, to a certain extent, artificial in practical application. The main difficulty will be the evaluation of the final results of economic performance. In this instance, enterprises would not simply fulfill quotas but would also strive for more complete satisfaction of national economic requirements.

Consequently, there is some doubt about the effectiveness of the new measures, because of (1) shortages of practically all goods and (2) the continued use of the quantitative index "production of tons." Better coordination between the individual sectors of the economy and a steady rise in efficiency could probably be achieved only if the Soviet leadership could permit a greater measure of market-oriented regulation and sanctions imposed by the market and if functioning mechanisms for this were to be established.

New wholesale prices are to be introduced in the U.S.S.R. on January 1, 1982. An estimated 12 million different prices will be involved. The last comprehensive reform of wholesale prices occurred in 1967. Retail prices will, in general, not be affected. An increase in the wholesale prices of fuel and raw materials will lead to higher costs not only in industry, but also in other sectors of the Soviet economy.

In the past 4 years there have been three official increases in prices. On January 5, 1977, prices were raised for certain consumer goods and travel. On March 1, 1978, gasoline prices were approximately doubled and coffee prices were approximately tripled. At the same time, the cost of gold and platinum increased by 60% and that of chocolate products increased by 30%. Prices on a number of goods in the U.S.S.R. went up on July 1, 1979; for example, automobiles increased by 18%; imported furniture increased by 30%; and articles made of precious metals increased by an average of 50%.

Much attention is now being paid to economic "integration" and industrial "cooperation" within the CMEA group of countries, and this tends to make East Europe, Mongolia, Cuba, and Vietnam more dependent upon the Soviet mineral industry. The East European countries are uniformly interested in the widening of economic contacts with the Western countries. The CMEA countries have adopted special programs for long-term cooperation until 1990 in energy, fuel, raw materials, the agricultural food industry, and machine building.

The Plan for Multilateral Integration Measures for the CMEA countries (1976-80), included among other Soviet projects, the joint construction and financing of the Kiyembay asbestos complex (both stages completed), the development of the Orenburg gasfield and gas pipeline from Orenburg to the Soviet western border (completed), the 750 kilovolt transmission line from Vinnitsa to the Hungarian border (completed), and new facilities for iron ore mining, ferroalloys production, and petroleum refining elsewhere in the U.S.S.R. (under construction). Reportedly, the total investment in joint projects involves about 9 billion transferable rubles by participating CMEA countries with provisions for repayment to be made in raw material produced (asbestos, iron ore, ferroalloys, natural gas, petroleum, and electrical power).

CMEA joint construction of nuclear powerplants, with a total capacity of 37,000 megawatts, is to start in the 1980's. The Khmelnitskiy nuclear powerplant in the Ukraine, with a capacity of 4,000 megawatts, is to be completed by 1984. The total investment in the project is expected to be 1,500 million transferable rubles, half of which will be contributed by the Soviet Union. Of the remainder, Poland is committed to deliver goods and services, including equipment and labor, to the value of 400 million transferable rubles; Czechoslovakia will supply the four reactors for the project, "technological" equipment, transport vehicles (including Tatra trucks), machine tools, and other machinery to the value of 240 million transferable rubles; and Hungary will supply communications equipment, buses, construction equipment, and building materials to the value of 110 million transferable rubles.

In return for their investment in the project, the three East European contributors will recieve, as full payment, electricity produced by the powerplant over the period 1984-2003; the amount of electricity each country will receive will be proportional to its investment. The Soviet Union will retain exclusive legal ownership of the powerplant.

The second nuclear powerplant has the same capacity of 4,000 megawatts, consisting of four 1,000-megawatt VVER-type reactors. It is apparently to be located in Konstantinovka in the Ukraine. It remains unclear which countries will participate and what their commitment to the project will be. Apparently, the three contributors to the Khmelnitskiy project (Czechoslova-

kia, Hungary, and Poland) will also contribute to the new scheme. According to "Economic Gazette," Romania will participate in this project and also in the installation of the Soviet-Romania-Bulgaria powerline.

In addition to its commitments under multilateral agreements with the Soviet Union, Poland has contracted to participate in the construction of more nuclear powerplants in the U.S.S.R. Under this bilateral agreement, Poland will take part in the construction of the Kursk and Smolensk nuclear powerplants. During 1980, 1,300 to 1,600 Polish workers were employed in the construction of various Soviet nuclear powerplants. Between 1982 and 1983 this number is planned to increase to about 4,500.

The Soviet Union is turning to its CMEA partners for assistance in improving the low level of recovery in its oilfields. Romania is the only other important oil producer in East Europe and it may be called upon to provide equipment and technology to increase oil recovery in return for Soviet oil deliveries. The U.S.S.R. has undertaken an extensive minerals development project in Romania in an attempt to further secure nonferrous metals.

Czechoslovakia has signed a contract to supply to the U.S.S.R. 300 locomotives of the CME-3 type and 600 trams of the T-3 and KP-4 types. The Grimme chemical engineering complex in Leipzig, the German Democratic Republic (GDR), will supply the U.S.S.R. with 26 oil-processing plants. The first has gone into trial operation at Surgut in Western Siberia.

A long-term program of economic, scientific, and technical cooperation between the U.S.S.R. and Yugoslavia was signed in September. The value of goods exchanged in the 1981-85 period is expected to total $26 billion, compared with about $16 billion in 1976-80.

Because of the limited availabilities of good-quality machinery, the U.S.S.R., in an attempt to accelerate the development of its mineral resources, is showing increasing interest in joint development ventures and in the exchange of scientific and technical services with foreign (mainly western) countries and firms. While the law prohibits any direct foreign capital investment in the U.S.S.R., the Soviet Union is anxious to attract West European, U.S., and Japanese firms to participate in joint production and marketing. Foreign investors are invited to develop deposits and to construct plants in the U.S.S.R., and repayment is promised in the form of commodities produced by these operations. The joint ventures should give the Soviets help with one of their biggest problems, the efficient introduction and application of new technology.

The barter-type arrangements fall into two broad categories. The cost of a plant purchased from the West is repaid by goods produced by the plant or by other Soviet goods.

According to Soviet sources, the value of buy-back agreements and contracts is estimated at several thousand million rubles for many projects in the chemical, petrochemical, petroleum, gas, and coal industries as well as in ferrous and nonferrous metallurgy. Some of the arrangements with the West have also involved CMEA joint investment projects. This category includes the agreement with Austrian, French, Italian, and West German firms for the delivery of large-diameter steel pipes, fittings, equipment, and materials for developing the gasfields and building gas pipelines. Deliveries of natural gas will pay for the credits.

This type of transaction fits well with the Soviet planning system. The foreign trade organizations do not have to worry about the lack of hard currency, and the Soviets do not need to search for markets to earn the much-needed hard currencies.

In the 1976-80 period, compensation agreements were covered by 60 large-scale industrial projects with two-thirds of the projects in the chemical and petrochemical industries. Large amounts of imported equipment were supplied to enterprises in the coal and ferrous and nonferrous metal industries. Most compensation agreements do not fix prices on Soviet-produced commodities; they just formulate the principle of their adjustment to current world competitive prices. Many compensation projects are being constructed in the remote Eastern and Northern parts of the U.S.S.R.

Some metallurgical complexes under construction in the U.S.S.R., with imported equipment under compensation deals are: An electrometallurgical complex (direct reduction of iron ore) in Staryy Oskol, Belgorod Oblast', supplied with equipment by West German firms; the Nadezhda nickel-copper-platinum-group metals dressing and smelting complex in Norilsk, equipment is supplied by Finnish firms; a large alumina plant in Nikolayev, Ukraine, and a primary aluminum plant in Sayansk, Siberia, equip-

ment supplied by French firms; and a mining and iron ore concentration complex in Kostomuksha, the Karel Autonomous Republic, with the participation of Finnish firms.

Reportedly, in December 1980, the Japanese Export-Import Bank signed a contract providing the U.S.S.R. with loans totaling $1,000 million (208,800 million yen). The loans, which will carry an annual interest of close to 7.25%, will help finance the Neryunga coal and forestry development projects in Siberia.

U.S.S.R. and West Germany are expanding their long-term economic and industrial cooperation, as outlined in the Soviet-West German 25-year agreement signed on May 6, 1978. The agreement foresees joint exploration for oil and natural gas in coastal regions of the Soviet Union, and joint projects to exploit and process raw materials and metals. A long-term program for the development of economic, scientific, technical, and industrial cooperation between the U.S.S.R. and Austria in the period 1981-90 was signed on January 19, 1980.

A U.S.-Soviet-Japanese project for developing natural gas reserves in Yakutia has been indefinitely postponed.

The U.S.S.R. Ministry for Production of Mineral Fertilizers was setup in October 1980. It was signed out from the U.S.S.R. Ministry of Chemical Industry to accelerate development of the mineral fertilizers industry.

The Soviet Union encourages state control over mineral resources in developing countries. The U.S.S.R. sends out technical advisors and makes loans to countries willing to promote state development and distribution of fuels and minerals. Soviet technical assistance and economic aid programs include several hundred projects at a cost of over 5 billion rubles. The CMEA International Investment Bank has setup a special fund of 1 billion rubles to grant credits for economic and technical assistance to developing countries. The fund started functioning in January 1974. During 1980, the number of CMEA technicians rose to 90,000.

Soviet influence in developing countries is based on substantial armament deliveries and economic aid which, in recent years, has reached record proportions. The U.S.S.R. grants economic, scientific, and technological aid to 90 Asian, African, and Latin American countries. Soviet aid in mineral extraction, particularly in bauxite, is geared to sustaining the huge requirements of the Soviet domestic economy. These requirements, apart from political considerations, have brought about a large-scale effort to develop foreign mineral sources of supply. Thus, in many instances, the assistance to developing countries is linked with mineral supplies to the U.S.S.R.

The Soviets have been racing to develop foreign mineral sources of supply. The U.S.S.R. has negotiated many technical and economic assistance agreements with mineral-rich developing countries. In many instances, the assistance to developing countries is linked with mineral supplies to the U.S.S.R.

The U.S.S.R. and Morocco have started implementation of a large-scale, long-term (20 years) agreement on economic and technical cooperation in the sphere of phosphates. The project is the development of the Meskala phosphate deposit and is estimated to cost $2,000 million.

In Asia, the Soviet Union and other CMEA members are helping Iraq develop its mining, oil processing, and power engineering. More than 100 projects have been built or are under construction with Soviet aid. The U.S.S.R. has provided vast sums of money for the development of India's steel industry and construction of powerplants. It has aided India in coal mining and in exploration for oil. Soviet-Turkish discussions on the expansion of economic and technological cooperation in energy, ferrous and nonferrous metallurgy, oil refining, and other fields continued in 1980. An agreement on coordinating the 1981-85 Soviet and Laos state plans was signed on September 12, 1980.

In Africa, the first Nigerian metallurgical works is to be built with Soviet assistance. The capacity of this plant is to be 1.3 million tons per year of steel. It will be built near a deposit of iron ore discovered and proved by Soviet geologists. Under an agreement, the U.S.S.R. will help Ethiopia in the construction of cement works and in prospecting for oil and gas. Reportedly, Brazilian officials are in favor of the formation of a Soviet-Brazilian metallurgy cooperative, proposed in November by a Soviet delegation visting there.

Mineral Industry Technology.—The Soviet Union employs over 3 million scientists and technicians in research and development, and spends over 20 billion rubles annually for scientific work. It has long occupied first place in the world in the number of engineering graduates employed

in its economy and also in the number of students graduating from higher technical schools. In nonferrous metallurgy alone, there were over 40 scientific-designing institutes, which employed over 12,500 professionals including 100 Doctors of Sciences and 2,600 Kandidates of Sciences.[11] There are more than 3.5 million engineering graduates at work, compared with about 1 million in the United States. This fact is frequently cited in Soviet publications, apparently as evidence of the country's advanced state of technical development. However, a straight comparison of the numbers of engineering graduates ignores the quality and effectiveness of their preparation. This view is borne out by numerous references in the Soviet press concerning the poor qualifications of technical personnel.

Soviet technology for reducing alumina to aluminum is about 10 to 12 years behind Western technology. Pechiney Ugine Kuhlmann Corp. of France is helping the Soviets build the U.S.S.R. aluminum industry. The U.S.S.R.'s steel industry relies heavily on open-hearth furnace production. The Soviets lag in powder metallurgy electric steel and stainless steel production.

The mechanization of labor intensive manual work in the Soviet economy is proceeding very slowly. In the past several years, the number of manual workers has increased substantially and at many mines and plants up to one-half of the production workers were employed in manual labor, including surface loading and unloading. According to *Problems of Economics*,[12] there were about 45 million manual workers in the Soviet economy in 1974. The work performed manually without machines is indicated by the following figures: 55.7% at coal mines, 60% at longwalls, 57% in development, and 100% on repair of workings. At nonferrous mines and plants in Kazakhstan, manual labor comprises 54% and planned production goals are met by increasing the level of manual operations. More than 50% of the heavy and labor-intensive operations at ferrous-metallurgical enterprises have to be done manually. Over 67% of the workers in blast furnace production perform manual operations. The situation is somewhat better in steel-smelting production, where 55.8% of the workers perform manual labor.[13]

The equipment currently used in mining is not large by Western standards. Excavators with scoop capacities of 4 to 8 cubic meters and dump-trucks of 20- to 40-ton capacity are mainly used instead of 12- to 20-cubic-meter shovels in combination with trucks of 110- to 180-ton capacity that are actually required. The use of the 500-horsepower bulldozer to replace four of the T-100s now in use makes it possible to release 12 workers.[14] The main trouble, however, is that the machine builders have been failing to manufacture new equipment for many years. Over the past 10 years, only one-third of the equipment ordered for nonferrous metallurgy has been supplied.[15]

Equipment used in the Soviet mineral industry is standardized and of types made earlier in Western Europe and the United States.The production of mining equipment has grown substantially, but the technical standards and the quality is poor. Production facilities are enlarged chiefly by quantitative expansion of the equipment with very inadequate replacement of obsolete and worn-out machinery, and replacement frequently does not affect the technical level of production. As a result of this extensive growth in the production facilities, the number of jobs rises much faster than the number of workers that can fill them.[16]

The reserves in the thin coal seams of the Donets Basin account for 83% of the total. But the equipment for mining thin seams is not available, and they are mined by old, wide-cut equipment. Chokotka, like the rest of the north, is experiencing a shortage of equipment specifically designed for northern use.

The tunneling machines, manufactured by the Yasinovatskiy machine-building plant and the new excavators type "EKG-8u" are of very poor quality and tend to breakdown after a few days of operation.[17] The lack of pilot and experimental facilities is only one of the reasons for the delays encountered by the implementation of technical innovations.

Because of the poor quality of equipment and shortage of spare parts, many excavators, dump trucks, and other equipment stand idle for long periods of time. For example, half of the 27- and 40-ton dump trucks at the Dneprovsk iron ore mining and concentration complex in the Ukraine are badly in need of repair. Because of shortages of spare parts and materials, in the first half of 1979 alone, the shovels stood idle waiting for repair for more than 37,000 machine-hours and the dump trucks waited 75,000 machine-hours. The peletizing plant

at this complex is not operating consistently.[18] The repair shop has not been constructed at the Mikhaylovsk iron ore mining and concentration complex in the Kursk Magnetic Anomaly area. This resulted in unsatisfactory conditions of mechanization at this complex.[19]

Almost 30% of the concentration plants in the nonferrous industry continued to underfulfill the planned targets for the extraction of metals into concentrate. The greatest number of plants that do not meet their extraction quotas are in Kazakhstan, Uzbekistan, and in the Urals. Among them are the Tekeli, Kentau, Almalyk, Kirovgrad, and Sredneuralsk concentration plants. Above-quota losses of metals are the result of poorly organized technological sampling of deposits, an uneven-paced delivery of ore to concentrators, and deviations from the planned composition of ore to be treated.[20]

The majority of nonferrous metallurgical plants and especially Norilsk (Cu-Ni-Co-Pt), Pechenga (Cu-Ni-Co-Pt), Severonikel (Cu-Ni-Co-Pt), Yuzhuralnikel (Ni), Krasnoural'sk (Cu-Au-Ag), Ufaleysk (Ni), Sredneuralsk (Cu-Au-Ag), Chimkent (Pb), and the Elektrotsink (Zn), have not met their planned targets for the recovery of metals.[21]

Recovery of copper from copper-zinc ores in the Urals ranges from 70% (Sibay) to 87% (Kirovograd), average 82.9%, and that of zinc ranges from 47% (Gay) to 74% (Sibay), an average 60%.

Processing of ores at the nonferrous concentration plants in Kazakhstan increased in 1980 by 13% compared with that of 1972, but the content of lead decreased by 24.5%, and that of zinc decreased by 38.9% (relatively) during that period.

Many projects have operated over a long period with lower capacities than originally planned. For example, in January 1980, only 6 of Kazakhstan's 23 nonferrous industry complexes attained designed capacity. At the Madneulskiy mining and concentration complex, designed capacity for mining of ore was attained by only 26% and that at the Urupskiy mining and concentration complex by only 50%. At the Achinsk alumina plant designed capacity was attained by 73% and that at the Krasnoyarsk primary aluminum plant by 75%.[22] Unattained designed capacities could have produced 11 million tons of cement in 1980.[23]

At many Soviet mineral industry enterprises, the number of workers greatly exceeded the design parameter. For example, the Zodskiy gold ore mine in Armenia employed 220 persons above the planned quota and at the Karamken gold ore mine in the Soviet Far East almost 400 employees were above the planned quota in 1980.[24]

The Soviet economy is going through one of its worst periods since the end of World War II, and a rapid increase in productivity is needed. The planned average annual increase of productivity for the period 1976-80 was 6.1%, but the actual official increases have been 3.3% in 1976, 4.0% in 1977, 3.6% in 1978, 2.4% in 1979, and 2.6% in 1980. The 1981 plan calls for an increase of 3.6%, much too high a figure. As there can be little hope of an increased total labor force, the growth of production can only come from increased productivity. However, the yearly average labor productivity growth has been decreasing.

Transfer of Technology.—Scientific and technological cooperation with developed Western countries holds an important place in the system of foreign economic relations of the U.S.S.R. Recently, these programs have become longer term and larger in scale. Western technology is a key factor that can favorably influence Soviet economic performance. The transfer of technology and licensed manufacture of products is largely one-sided, with the U.S.S.R. usually on the receiving end. The import of Western technology does not resolve many of the contradictions in the Soviet economy, but it does accelerate industrialization.

The rate of growth in Soviet trade with the West will slow substantially during the next few years. In the 1973-78 period, Western companies completed more than 60 compensation agreements. In the next 5-year period (1981-85), Soviet planners expect that only 15 new compensation projects will be completed. According to Soviet sources, projects for the chemical industry will receive less attention in the future. Demand for Western technology by the U.S.S.R. is unlikely to diminish and the gap between Eastern and Western technology will continue.

In the past decade, the Soviet Union has made a major effort to catchup with Western technology. Some progress has been made, but import of Western technology does not resolve many of the contradictions in the Soviet economy. Imports of Western technology and equipment have not given a sharp boost to Soviet productivity.

The Soviet Union has technical cooperation with Austria, Belgium, Britain, Denmark, Spain, Italy, Canada, the Nether-

lands, Norway, Portugal, Federal Republic of Germany (FRG), Finland, France, Switzerland, Sweden, and Japan. U.S. exports of high technology items to the U.S.S.R. will continue to be banned for the foreseeable future. The Soviets' scientific and technical ties with the industrially developed Western countries are an important element in the development of Soviet industry.

West Germany was the largest Western exporter of equipment and machinery to the U.S.S.R. in 1980. Its involvement includes deliveries of trucks for the construction of the Baykal-Amur Main Railway (BAR), the Kama automobile works, the Oskol metallurgical complex, and a number of large chemical complexes. Daimler Benz has received Soviet orders worth Deutsche marks (DM)15 million for 150- to 320-horsepower trucks. Krupp of Essen is to build an electrosmelting plant at the Soviet iron and steel complex in Staryy Oskol, near Kursk, which is to start operating in 1982. Under the contract, signed in Moscow in March 1979, four electric furnaces are to be installed, mainly for the production of high-grade steel (1.45 million tons per year). The contract is worth about DM350 million to Krupp, and the total cost of the electric steel plant is estimated at DM600 million. The project is largely being undertaken by Krupp and four other German companies. Within the framework of an agreement worth DM50 million, the Schiess AG Group will supply a mill capable of working pieces weighing up to 800 tons.

Reportedly, a Klockner-led consortium has signed a contract with the Soviet Metallurgimport for the supply of a carbon-anode plant for the Sayansk aluminum complex in southern Siberia. The contract, worth DM555 million, includes the supply of equipment worth F 420 million from the French Klockner subsidiary. The anode plant will have a capacity of 350,000 tons per year and will be installed in the 400,000- to 500,000-ton-per-year Sayansk aluminum complex. The first of five potlines at the smelter is scheduled to begin operation early 1984.

In June 1980, the U.S.S.R. State Committee for Science and Technology and the West German company Hoesch signed an agreement on the technology for making pipes for oil and gas pipelines. Under the agreement, the FRG is to receive considerable quantities of Soviet natural gas. In June, Soviet Mashinoimport and the West German firm Borsig signed a contract for the delivery to the U.S.S.R. of valves for gas pipelines and compressor installations for the chemical industry. Carl Schenek of the FRG has announced that its group of companies has won a Soviet order for vibroscreens for a large coal preparation plant. The total order is for 33 screens, each 9.5 meters by 2.9 meters of the latest design.

The large crane ship Azerbaydzhan, which had been built by Blom and Voss in Hamburg on Soviet order, was put into operation in Baku. The giant crane is able to lift steel structures weighing thousands of tons to a height of 32 meters and install them in offshore areas at depths of as much as 300 meters. This is more than three times the depth at which Caspian engineers have worked before.

The Soviet Union and France have signed agreements on scientific industrial and technical cooperation for 1980-90 and an economic cooperation for 1980-85. In 1980, French companies concluded a number of large new contracts for supplying the U.S.S.R. with plants and equipment for various branches of industry amounting to over F 3,000 million. These include in particular: Creusot Loire SA was given the $350 million order from the U.S.S.R. for the construction of an electrical steel plant, with a capacity of 480,000 tons per year. In April, French Pont-a-Mousson signed a contract to build a plant in Lipetsk to produce 180,000 tons per year of 100- to 300-millimeter diameter steel pipe. A new rolling mill has been commissioned at the Moscow pipe plant, the second mill to be delivered by the French firm Wean-Damiron. There is also a joint large-scale project under way—the construction of a gas trunk line, which may secure a supply of 10,000 to 13,000 million cubic meters per year of natural gas to France from the U.S.S.R.

The Soviet Union depends on Western, in particular United States, oil and gas technology. Reportedly, the U.S. Department of Commerce has approved 75 applications for the export of petroleum equipment to the U.S.S.R. The value of equipment and machinery to be delivered is understood to be about $280 million. Dresser Industries has sold a $144 million plant to manufacture oil drilling bits. The Soviet Mashinoimport has awarded a $15 million contract to International Enterprise Inc. of Oklahoma City, Okla. (United States), for 10 combination drilling rigs. The company exported six similar drilling rigs in 1977. The Caterpillar

Tractor Co. has sold to the U.S.S.R. some $1 billion worth of equipment for laying a natural gas pipeline from Siberia to Western Europe. Fiat-Allis Construction Machinery Inc. will sell 300 large bulldozers (model 31S with 425-horsepower) to the U.S.S.R. for about $90 million. The machinery has been designed to operate in temperatures as low as 40° below zero. The Soviet Union has been using Fiat-Allis model 41Bc, the company's largest with 500-horsepower, since 1974 in gold mining.

Reportedly, Montedison SpA of Italy and the Soviet Union signed a 10-year commercial and industrial cooperation agreement valued at $1,500 million. Montedison will supply equipment and technical assistance valued at $800 million for the construction of seven chemical plants in the U.S.S.R. The construction of these plants is to be completed by 1987. Montedison will purchase Soviet ammonia, crude oil, and other goods valued at $700 million. In 1931, Montedison built the first ammonia plant in the U.S.S.R. Between 1973 and 1979, Montedison built six Soviet chemical plants. Soviet Sudoimport has placed an order for three cargo ships with the Viana do Castelo shipyard of Portugal. The vessels are to be delivered to the U.S.S.R. by January 1983.

The 5-year extension of the Finland-U.S.S.R. 15-year agreement (to 1995) and the agreement for cooperation in stages II and III of the Kostamus project was signed in November. According to the agreement, the production capacity of the Kostamus complex under construction will be raised from 3 million tons per year to 9 million tons per year of iron pellets. The value of this agreement is about $750 million. It is planned to complete stage I by 1982.

The semisubmersible offshore drilling rig, constructed in Finland on Soviet order, has arrived. Wells can be drilled up to 6,000 meters deep through water up to 200 meters deep. Three floating Arctic drilling ships are being built for the U.S.S.R. in Finland. The ships are designed to work in waters as deep as 300 meters and drill to 6,000 meters. The first such ship is due in 1981. The shipbuilding firm of Waertsilae has contracted to supply the U.S.S.R. with seven river icebreakers in 1983-84. The value of the order is about FM700 million. Soviet Sudoimport has signed a contract with the Finnish firm Laivateollisuus for five research ships. The Rauma Repola of Finland has received a 500 million Finnish marks order for the construction of 12 cargo vessels and drilling ships. The Valmet Engineering Co. of Finland has received an order worth nearly $50 million from the U.S.S.R. for the construction of five Arctic cargo vessels to be used on the rivers of northern Siberia. Discussion on Soviet-Finnish cooperation on the construction in Finland of a nuclear powerplant continued in 1980.

The Soviet Union and Austria have signed an agreement on cooperation in the manufacture and marketing of nuclear energy equipment. This will cover the construction of a turbine plant in Leningrad and the supply of Austrian equipment for a nuclear research center being built with Soviet assistance in Libya. Reportedly, Denver Equipment (United States) has completed delivery of the first stage of an order valued at L500,000 for a large iron ore project in the U.S.S.R. The complete order involves the supply of two thickeners (30 meters and 55 meters in diameter), four agitators (18.3 meters by 13.7 meters), together with a number of slurry pumps and auxiliary equipment. The Export-Import Bank of Japan has granted the U.S.S.R. credits of more than $200,000 million for the development of timber and coal resources of Siberia and the Soviet Far East. Most of the money will be spent on buying Japanese equipment for these projects. A long-term agreement providing for the further expansion of Soviet-Japanese cooperative trade was signed in December 1980.

Over 90% of the natural gas supplied by the U.S.S.R. to Western Europe is exported under compensation agreements signed between 1968 and 1974. Discussions with West German energy companies on the construction of a 4,500-kilometer natural gas pipeline, from Western Siberia to Europe at a cost of $11,600 million, continued in 1980. It could be in operation by 1986 with a 40,000-million-cubic-meter-per-year capacity.

A 3,000-millimeter rolling mill for the Il'ich plant in Zhdanov has been imported from Czechoslovakia. The mill will produce special high-quality steel sheet 5 to 25 millimeters thick for oil and gas pipelines. Equipment for the third stage of Cuba's only steelworks is to be supplied by the U.S.S.R. and Czechoslovakia in 1981-88. The total capacity of the plant (three stages) is to be 680,000 tons per year. The Soviet Union will supply equipment for the third stage of the Bruno Leuschner nuclear powerplant in the GDR, which has a capacity of 880 megawatts. A 400,000-ton-per-year

continuous slab caster for Bulgaria is under construction at the Uralmash plant in Sverdlovsk, U.S.S.R. The design of the third stage of the Kozloduy nuclear powerplant in Bulgaria is to be done by the U.S.S.R. The basic equipment for this stage is to be supplied by the Soviet Union in 1983.

The U.S.S.R. and Yugoslavia have concluded a second contract for the export to the Soviet Union of 20 steam separators for 1,000-megawatt nuclear powerplants. The value of the contract is about $170 million; the first consignment is to be sent in the second half of 1981. The first contract also provided for export to the U.S.S.R. of 20 separators, 13 of which have been supplied. The second stage of the Novi Sad oil refinery is being built with Soviet help. The basic materials and equipment have already been delivered from the U.S.S.R. The Soviet Union is also assisting in building the Skopje oil refinery in Yugoslavia.

The U.S.S.R. has officially confirmed that it is to continue to provide assistance to India in expanding the steel industry along with plans for the development of India's coal, oil, and aluminum industries. According to an Indian-U.S.S.R. agreement for 1980-82, Soviet know-how will be available for improving Indian steel plant technology. Construction of Sail's Vizag steel plant, with a capacity of 3.4 million tons per year to be completed by 1988. Under an Indian-Soviet agreement concluded in October 1980, the U.S.S.R. is to provide India with the latest know-how on coal mining and to help redesign its coal washers.

The Soviet Union plans to assist Iran with construction of an 800-megawatt thermal powerplant. Reportedly, the U.S.S.R. has offered to supply badly needed spare parts for Iran's oil and gas production equipment. The Soviet Union is assisting Pakistan with construction of a 1.1-million-ton-per-year steel works project at Birr Oasim near Karachi. The majority of the cost of the project is to be met by credit from the U.S.S.R. Soviet experts are working with the Vietnamese to put the offshore drilling project for oil and gas into commercial operation in 1982. The U.S.S.R. is assisting Mongolia in the construction of the Hotd cement and lime complex.

In April, Algeria and the Soviet Union signed an agreement to extend scientific and technical cooperation. The U.S.S.R. is to assist in construction of a 630-megawatt thermal powerplant. In Ethiopia, the Soviet Union is renovating the 600,000-ton-per-year Assab oil refinery. The U.S.S.R. and Nigeria have resolved differences arising from delays in the construction of the Ajaokuta steel project. The first stage, with a capacity of 400,000 tons per year of slab, is now set to come onstream in the first half of 1981. Construction of a mining and concentration complex was completed at Mfouati in the People's Republic of the Congo with Soviet technical and financial assistance. The enterprise is to produce 30,000 tons per year of lead and zinc concentrate. Part of the concentrate is to be sent to the U.S.S.R. The Soviet Union and Mozambique have signed a major economic agreement that covers mining, industrial, agricultural, and shipping areas.

A joint commission to exchange technological information has been established by the U.S.S.R. and Bolivia. Faster construction of the Lia Palca low-grade tin volatilization plant in Potoci and the start of construction for a similar plant at Machacamarca, in Oruro, have been discussed. According to Bolivian sources, the U.S.S.R. is interested in cooperation with Bolivia in the search for the exploitation of hydrocarbons. The second hydroelectric powerplant is being built in Brazil with Soviet technical and financial assistance. Reportedly, after studying the power-generating potential of the country's rivers, a group of Soviet experts have prepared a report on the feasibility of building a hydroelectric powerplant in Nicaragua. In 1981-85, the U.S.S.R. is to provide Cuba with assistance in the construction of an 880-megawatt nuclear powerplant and a metallurgical works with a capacity of 1.3 million tons per year of steel.

Indian, Algerian, and Turkish blast furnace, steel, smelter, and rolling mill operators are being trained at the Soviet Azov plant in Zhdanov. More than 100 technicians from Asia, Africa, and Latin America have been trained at the plant's school for improving the qualifications of production leaders from developing countries over the past 10 years.

The 11th 5-Year Plan (1981-85).—The 5-year plan for 1981-85 was ratified by the 26th Congress of CPSS on March 2, 1981. The targets of the 10th plan (1976-80) were to be high in most of the important economic areas, but the 11th plan (1981-85) is characterized by reduced ambitions. Industrial output in the 5-year period is to be increased by 26% to 28%, including means of production (Group A) by 26% to 28%

and consumer goods (Group B) by 27% to 29%. Labor productivity in industry is to be increased by 23% to 25%. More than 90% of the increase in production must be derived from this plan. The number of workers involved in manual labor in all branches is to be steadily reduced, especially in auxiliary work. The quality of all products is to be improved.

Capital investments are to be concentrated on the most important projects that were due for startup during previous years, and, above all, on the reconstruction and technical reequipping of existing enterprises. Construction of new production projects is to be restricted in the European part of the country.

Over the 5-year period, a saving of fuel and energy resources amounting to 160 to 170 million tons of standard fuel is to be secured, including 70 to 80 million tons resulting from reduced consumption. There is to be a reduction in consumption of ferrous rolled metal by no less than 18% to 20%, of steel pipe by 10% to 12%, and nonferrous rolled metals by 9% to 11% in machine building and metal processing. There is also to be a saving of ferrous rolled metal and timber materials by 7% to 9% and of cement by 5% to 7% in the construction sector.

Utilization of fuel and energy resources must be improved. Consumption of oil and petroleum products, such as boiler and furnace fuel, must be reduced. The nuclear power industry must be developed at an accelerated rate. Extensive use must be made of comprehensive processing of raw materials, resource-saving technology, and technological processes that produce little or no waste. Utilization of production facilities and basic assets must be improved.

The unit capacities of machinery and equipment are to be raised to an optimum with a simultaneous reduction of their dimensions, metal input, and power consumption, and lowering the cost of production per unit.

The following data show the principal goals for individual mineral commodities in the new 5-year plan:

1. The generation of 1,500 billion to 1,600 billion kilowatt-hours of electricity in 1985 is planned, including up to 220 billion to 225 billion kilowatt-hours at nuclear powerplants and up to 230 million to 235 million kilowatt-hours at hydroelectric powerplants. The increase in electricity generation in the European part of the U.S.S.R. must be ensured, mainly, by nuclear and hydroelectric powerplants. New facilities of 24 million to 25 million kilowatts of nuclear powerplants must be put into operation. Construction of thermal powerplants using coal from the Ekibastuz and Kansk-Achinsk Basins, as well as natural and associated gas from West Siberian fields, must be carried out at an accelerated pace.

Construction of the Smolenskaya, Kalininskaya, Kurskaya, Balakovskaya, and Rostovskaya nuclear powerplants must be completed by 1985. The capacity of the Chernobyl, Yuzhno-Ukrainskaya, and Rovno nuclear powerplants in the Ukraine are to be increased and construction of the Khmelnitskiy, Zaporozhye, and Crimean nuclear powerplants and the Odessa thermocentral powerplant will start and the first stages are to be commissioned.

2. In 1981-85, crude oil and gas condensate output is to be increased 620 million to 645 million tons. The oil-extracting industry in West Siberia, Kazakhstan, and in the north of the country's European part must be developed at a faster pace. The application of new methods of treating oilfields must be expanded thus increasing recovery of oil from the strata. A progressive method of gas lift working of the wells and highly productive submersible electric pumps must be introduced. In 1985, the proportion of oil extraction at comprehensively automated oilfields must be increased 85% to 90%. Labor expenditures on drilling wells must be reduced by 15% to 18%. The production of oil and gas condensate in Siberia is to be increased in 1985 to 385 million to 395 million tons. Pipeline networks are to be expanded, mainly to bring oil from Siberia to the European part of the U.S.S.R.

It is planned to raise the volume of primary oil processing. In the Soviet Far East the development of the oil refining industry will expand. Construction of the Chimkent and the second stage of the Pavlodar refineries are to be completed by 1985. Efficiency of utilization of oil in the petroleum-refining industry is to be raised. A further deepening of its refining and reduction of losses of oil and petroleum products must be ensured. Large-tonnage production of aromatic hydrocarbons, liquid fuel, ethylene, petroleum, and eletrode coke must be attained. Production of highly effective additives to fuels and lubricants must be increased; and the quality of petroleum products produced must be raised.

3. Natural gas production is to be increas-

ed to 600 billion to 640 billion cubic meters in 1985. The production of gas in Siberia is to be increased to 330 billion to 370 billion cubic meters. Construction of powerful gas trunk pipelines must be implemented. There is to be a special effort to increase construction of underground gas storage units near large cities.

4. Raw coal (bituminous, anthracite, and lignite) production in 1985 is to be increased 7% to 12% over the 1980 level. This would bring production from 716 million tons in 1980 to 770 million to 800 million tons in 1985. Coal extraction is to be increased at a rapid rate by the surface method in the Kuznetsk, Kansk-Achinsk, and Ekibastuz Basins. Development of open pit coal, the construction of a coal concentrator, and the first stage of the thermal powerplant at Neryunga in Yakutia must be completed by 1985. There is to be development of underground coal mining, particularly for coking requirements, and mining by hydraulic method. The quality of coal supplied to the national economy is to be improved. Conditions of labor and accident prevention are to be improved. The increase in coal production is to be brought about mainly by increasing labor productivity.

According to Soviet sources, over 7 million people work in the energy sector of the economy and over one-third of the capital investment in industry is used in the development of the energy complex.

5. Raw steel production is to be increased and output of finished rolled steel products is to reach 117 million to 120 million tons in 1985. In the iron and steel industry, special attention is to be devoted to improving quality and expanding the range of products. Increase in raw steel output is to be obtained by developing the oxygen converter and electric steel smelting methods. Electric steel production is to be increased by 60%. The amount of continuous-casting steel is to be raised to 35 to 37 million tons.

Expansion of the steel industry remains high on the list of priorities of the U.S.S.R., although the emphasis is swinging away from tonnage output toward improvement of quality and more efficient shapes of products. The production of cold-rolled sheet, rolled metal subjected to hardening by heat treatment and made from low-alloy steel, thin sheet metal including extremely thin sheet with protective coatings, cold-rolled strip, dynamo steel, special-section and high-precision rolled metal, and thick steel plate is to be increased 50% to 150%. The production of threaded pipes for the oil industry with new types of thread connection and anticorrrosive coatings, high-strength pipes for high-pressure boilers, pipes for bearings, and pipes for nuclear power engineering is to be developed at an accelerated rate. The production of multilayer pipes for a gas pipeline is to be attained.

There is to be rapid development of the raw material base of ferrous metallurgy. The metal content in iron, manganese, and chromium concentrates is to be raised. It is planned to put into operation the Stoylenskiy iron ore mining and concentration complex in the Kursk Magnetic Anomaly area, with a capacity of 9 million tons per year of concentrate and facilities for extraction of iron ore at the Kacharskiy mining and concentration complex in Kazakhstan in 1985.

6. In nonferrous metals, production of aluminum is to be raised 15% to 20%; copper production is to increase 20% to 25%; and nickel and cobalt production is to be increased by no less than 30%. There will be an increase in the production of zinc, lead, titanium, magnesium, precious metals, tungsten and molybdenum concentrates, columbium, and other alloying elements. The construction of mining and concentration complexes at new deposits is to be accelerated. Output of nonferrous metals is to be increased chiefly by raising labor productivity.

Kazakhstan will continue to be one of the largest producers of nonferrous metals. It is planned to complete construction of the second stage of the Zharmsk and the first stage of the Boshchekul mining and concentration complexes in Kazakhstan. Development of the Annensk and Spassk mines of the Dzhezkazgan complex, and new mining facilities at the Mirgamaliysk and Shalkinsk deposits in this Republic are to be completed by 1985.

The plan calls for construction of additional production facilities at the Pavlodar alumina plant and at the Ust'-Kamenogorsk lead-zinc complex (70 million rubles investment) in Kazakhstan. New potlines are to be commissioned at the Regar aluminum plant in Tadzhikistan, and production of aluminum is to start at the Sayansk plant in Siberia.

There will be a renovation of nonferrous enterprises in Armenia, as well as a major expansion of the Norilsk copper-nickel and platinum-group metals complex, which is to

be completed by 1985. It is planned to complete construction of the Orlovsk mining and concentration complex and the development of the Orlovsk and Spokoynensk polymetallic deposits in the Chita Oblast' by 1985. Output of copper and production of lead-zinc ore at the Almalyk complex in Uzbekistan are to be increased during the 1981-85 period. The 5-year plan also calls for the beginning of construction of a tin mining and concentration complex and completion of a gold complex in Tadzhikistan. Design work on the Udokan copper deposit in East Siberia is to be completed by 1985.

However, development of the Soviet nonferrous industry will face problems with mine depletion, declining metal content in the ore, and lagging development of new mining, concentration, and smelting facilities.

7. Output of mineral fertilizer is programed to grow by almost 50% to 150 to 155 million tons per year in Soviet standard units or 36 to 37 million tons in terms of 100% nutrient content. The most rapid rate of growth is to be in the production of phosphorous fertilizers. It is planned to increase output of apatite concentrate in the Kola Peninsula and expand the production of phosphate rock at Karatau in Kazakhstan by 50%. Output of potassium fertilizers in Belorussia is to be increased by 40%, and the output of concentrated and compound fertilizers is to be extended. From 1985, potassium fertilizers are to be supplied to agriculture only in granulated form. Labor productivity in this industry is to be increased by 28% to 30%. In 1985, the supply of mineral fertilizers to agriculture is to be not less than 115 million tons in Soviet standard units or 26.7 million tons in 100% nutrient content. Chemical feed additives are to amount to 5 million tons.

8. Geological prospecting activities are given special attention in the new 5-year plan, largely for exploration for oil, natural gas, and condensate fields in Tyumen Oblast, in Eastern Siberia, the European part of the U.S.S.R., Central Asia, and Kazakhstan, and on the continental shelfs. Prospecting for deposits of coking coal, energy coal, and lignites (particularly in the European part of the U.S.S.R.), for easily concentrated ores for ferrous and nonferrous industries, for precious metals and diamonds, for bauxite and raw materials, for the nuclear energy industry, and for the production of mineral fertilizers will continue in 1981-85.

9. The increase in output of machine building is to be no less than 40%. Labor productivity is to increase by 31% to 35%. Cement production is to reach 140 to 142 million tons in 1985.

10. About 3,500 kilometers of new railway lines were built in the 1976-80 period. The total length of Soviet railways is now more than 141,000 kilometers. In the new 5-year plan, no less than 3,600 kilometers of new railway lines are to be commissioned, over 6,000 kilometers are to be electrified, and more than 5,000 kilometers of double tracks are to be built. The entire length of the BAR is to be opened to rail traffic. The turnover of cargo by railway transportation is to be increased by 14% to 15% and passenger turnover is to increase by 9%. Labor productivity is to be raised by 10% to 12%.

In maritime transportation, the cargo turnover is to be increased by 8% to 9%. Construction of the second stage of the Vostochnyy deepwater port near Vladivostok in the Soviet Far East is to start during the new 5-year plan period. Pipeline transportation is to receive accelerated development, particularly for oil, natural gas, and petroleum products. The quality of construction of pipelines is to be raised. In air transportation, the network of airports will be developed, particularly in areas of the North Siberia and the Far East.

11. To carry out this plan, large resources will be required. Capital investment in the U.S.S.R. for the next 5 years has been set at a level of over 700 billion rubles, an increase of 12% to 15% over the preceeding 5-year period. Capital investment must be channeled first into reconstruction and technical reequipment of enterprises and into completion of construction projects started earlier. One of the most important developments under the new plan is the geographical shift in new projects.

In the European part of the country, and in the Urals, the further development of industry is to be implemented mainly by means of the better use of the production potential, which has already been created by reconstruction and technical reequipment of existing enterprises without increasing the number of workers. Nuclear power generation is to be extensively developed. The putting into use of hydropower resources of the North Caucasus and Transcaucasia is to be continued. In Siberia, the accelerated growth of fuel industry, electricity generation, nonferrous metallurgy, chemical, petrochemical, and construction industries is to be provided. The production

of crude oil, including gas condensate and natural gas, is to be increased considerably. In the Soviet Far East, there will be a further development of the nonferrous and the oil refining industries.

The average monthly wages of manual and office workers are to be raised by 13% to 16% and their level should be brought up to 190 to 195 rubles a month by the end of the 5-year period. The income of collective farmers is to be raised by 20% to 22%.

The level of Soviet industrial production in 1980 and as planned for 1985 is given in table 2.

Table 2.—U.S.S.R.: Soviet industrial production in 1980 and planned 1985

(Million tons unless otherwise specified)

Commodity	Production		Increase	
	1980 reported	1985 planned	Quantity	Percent
Coal, raw (bituminous, anthracite, lignite)	716	770-800	54-84	7-12
Petroleum, crude, including condensate	603	620-645	17-42	3-7
Natural gas (billion cubic meters)	435	600-640	165-205	38-47
Steel, raw	148	NA	NA	NA
Rolled finished ferrous metal	103	117-120	14-17	14-17
Mineral fertilizers (Soviet standard)	104	150-155	46-51	44-49
Mineral fertilizers (100% nutrient content)	25	36-37	11-12	45-49
Cement	124	140-142	16-18	13-15
Power, electric (billion kilowatt-hours)	1,295	1,550-1,600	255-305	20-24

NA Not available.

It has been estimated that in the 1981-85 period, a growth of fuel output of all types of primary energy will amount to 16% to 17% or 300 million to 320 million tons of standard fuel. There will be definite changes in the structure of fuel and power production. These changes will include a reduction of the share of oil, a sizable growth of the share of natural gas, and a growth of hydraulic and nuclear power generation. The existing large losses of fuel and energy will continue in the 1981-85 period.

The output of crude oil including gas condensate, will grow over the next 5 years by 25 million to 35 million tons, which means the total production in 1985 will be between 625 million and 640 million tons. The slowdown of the growth rate of oil production in the Soviet Union stems mainly from low labor productivity and shortages of labor, equipment, and materials.

Soviet natural gas output increased by 140,000 million cubic meters over the last 5 years. This growth will probably continue in the next 5 years, which will bring the Soviet natural gas production up to 580,000 million cubic meters in 1985. A reduction of the share of coal in the total production of primary energy toward 1985 is going to be accomplished by not more than 7%, which will amount to 770 million tons of raw coal and lignite in 1985. But the quality of coal (ash content and other impurities) will decrease over the next 5 years by at least 8%.

The overall volume of fuel and power exports from the U.S.S.R. amounted to over 300 million tons and imports were about 26 million tons of standard fuel in 1980. More or less the same amount of fuel and power will be available for export in 1985. The greater number of exports will be shipped to CMEA countries. It is expected that exports of fuel and power to CMEA nations will be raised by about 20% compared with that of the previous 5 years. The U.S.S.R. will keep exporting fuel to Western and developing countries. The amount of this export will depend on world prices of oil, gold, platinum-group and nonferrous metals, and other mineral industry commodities, which are the main earners of hard currency to pay for imports.

The years covered by the 1981-85 5-year plan are to be difficult for the U.S.S.R. and a slower pace for economic activity is expected in the future (after 1985).

The Plan for 1981.—The state plan for 1981, set as part of the 1981-85 plan, was ratified by the Supreme Soviet on October 23, 1980. A significant cutback in the industrial growth target confirms that the economy will suffer its third worst year since the Second World War. The growth of national

income planned for 1981 at 3.4% represents the lowest planned target in the last 10 years. It is also lower than all the figures for growth of national income actually achieved under the 9th and 10th 5-year plans, except that of 1979. More or less, the same can be said of the 4% increase in industrial production projected for 1981, the only difference being that this figure is a little higher than the actual level achieved in 1980.

It is evident that the Soviet leadership is expecting a further slowdown in economic development in 1981, is not regarding current difficulties as being of a temporary nature, and is entertaining no hopes of any real improvement in the economic situation.

It is worth noting that the Soviet leadership has once again demonstrated a desire to give somewhat more priority to the production of consumer goods in 1981. Admittedly, the margin is very slight, a 4.2% increase for consumer goods compared with a 4.1% increase for capital goods. Similar attempts have been made in the past but have been quickly forgotten, with preference once again being given to heavy industry. Nevertheless, the possibility cannot be ruled out that this slight margin in favor of consumer goods will be achieved, as was the case in 1971 when consumer goods showed an increase 0.2% higher than capital goods.

The Soviet leadership does not seem to be expecting any substantial improvement in agriculture where planned gross output at 7.5% is lower than the average of 9% annual growth achieved under the 10th 5-year plan.

Capital investment is to total 140 billion rubles, a 4.9 billion increase over that planned for 1980. State capital investment is planned at 124.1 billion rubles in 1980, a 5.2% growth over the 1980 planned level. Investment will be significantly increased in the "basic branches of industry" and consumer goods. Compared with that of 1980, higher rates of growth in investment will be for electrical generation, fuels, chemicals, ferrous and nonferrous metallurgy, machine building, the electrotechnical industry, light industry, transport, and others. The capital investment in the fuel and power sector will be increased by 9.4% compared with that of 1980.

In 1980, crude oil and condensate output increased by 112 million tons compared with that of 1975. Production of crude and condensate in 1980 was 17.4 million tons over the 1979 level. The 1981 plan calls for production of 610 million tons of crude and condensate, only 7 million tons more than the 1980 level. Pipeline networks are to be expanded, mainly to bring oil from Siberia to the European part of the U.S.S.R. It is planned to put into operation the Tyumen-Yurgamysh, Perm-Almatyevsk, and the Krasnoleninskiy Svod-Shaim oil pipelines in 1981. The aggregate capacity of oil refineries is to increase by 6 million tons, including the first stage of the Achinsk oil refinery in Krasnoyarsk Kray.

The brightest spot in the energy picture is natural gas. About 435 billion cubic meters were produced in 1980 and the goal for 1981 is up 5.3% to 458 billion cubic meters. All of the growth in gas production is to come from Western Siberia, which is to supply 42% of the total produced, and more than half of Soviet oil output is to come from that area. A 5,600-kilometer addition to trunk and branch gas pipelines is also planned. The 1,273-kilometer Urengoy-Nizhnyaya-Turna-Petrovsk pipeline and the 2,000-kilometer Urengoy-Nadym-Punga-Ukhta-Gryazovets-Torzhok pipeline are to be commissioned in 1981. Raw coal and lignite mining in 1981 is planned at 738 million tons. Production was 719 million and 716 million tons in 1979 and 1980 compared with planned output at 752 million and 745 million tons in 1981. The main increase is to be from open pit lignite operations in Kazakhstan and Siberia. Increased coal production is to be from the Kuznetsk, Karaganda, Ekibastuz, and Kansk-Achinsk basins.

The plan does not mention the 1981 quotas for production of pig iron, raw steel, and iron ore. Finished rolled output is planned at 109.2 million tons and that of steel pipe at 18.5 million tons. It is planned to attain an output of 140 new shapes of ferrous rolled products. Completion of the renovation of blast furnace No. 2 with a capacity of 420,000 tons per year at the Rustavi works in Georgia and the "2,000" rolling mill at the Cherepovets works were rescheduled for 1981. Renovation of the "2,500" rolling mill at Magnitka and the "900-750" mill at the Dzerzhinsk plant in Dnepropetrovsk are also to be completed in 1981. The oxygen-converter shop No. 2 at the Novolipetsk complex is to be put on-stream. It is also planned to commission additional facilities for iron ore production at the Mikhaylovsk (Kursk region) mining and concentration complex and the Shere-

goshsk Mine in Western Siberia with a capacity of 2 million tons per year of crude ore each. In 1981, iron ore production facilities are to be increased by 14 million tons of crude ore per year.

According to 1981 targets, the country's fertilizer production will be 113.8 million tons (Soviet standard), an increase of 9.8 million tons over that of 1980. The generation of electric power is to be increased by 3.5% to 1,335 billion kilowatt-hours. In 1981, nuclear power generation is to be developed in the European part of the U.S.S.R. Two 500,000-kilowatt units are to go onstream at the Kursk nuclear powerplant. New facilities are to be commissioned at Chernobylsk, Rovensk, Smolensk, and other nuclear powerplants. Cement production is to be increased by 4.5 million to 128.5 million tons in 1981.

Railway capital investment is planned at 8.8% over the 3,700 million rubles planned for 1980 (excluding expenditures on the BAR). About 760 kilometers of new track, 860 kilometers of double track, and 1,000 kilometers of electrified track are to be completed in 1981.

Soviet priorities for the 1980's will continue to be the vital oil, gas, and machine-building industries. Oil and gas production are so important (as energy and hard currency sources) that adjustments will be made elsewhere to ensure fulfillment of the planned targets. There will be continued exports of petroleum and natural gas and imports of steel pipe, pipelining, and petroleum and natural gas extraction equipment.

Table 3.—U.S.S.R.: Soviet industrial production

(Million tons)

Commodity	1980		1981
	Planned	Reported	Planned
Pig iron	115	NA	NA
Steel, raw	157	NA	156.8
Rolled finished ferrous metal	109	103	109.2
Coal, raw (bituminous, anthracite, lignite)	745	716	738
Petroleum, crude including condensate	606	603	610
Natural gas (billion cubic meters)	435	435	458
Mineral fertilizers (Soviet standard)	115.5	104	113.8
Steel pipe	18.5	18.2	18.5
Cement	NA	124	128.5
Power, electric (billion kilowatt-hours)	1,295	1,295	1,335

NA Not available.

Exploration.—There are more than 20,000 explored mineral deposits in the country. Over 5,000 deposits of various minerals were being exploited in 1980. According to Soviet sources, the U.S.S.R. accounted for 28% of world mining output and for one-quarter of the world mineral production in 1980. Up to 40% of capital investment in industry is spent on exploration and mining of minerals. Expenditures on geological prospecting for the years 1950-80 increased by a factor of 8, and in 1980 they amounted to about 5 billion rubles. They will continue to increase annually by 5% to 8%. Extensive prospecting and exploration for practically all commodities was carried out on a large scale. There were over 500,000 employees in the geological and prospecting organizations in 1980, including over 120,000 graduate specialists with university and technical education. The Ministry of Geology had 36 research institutes and 2 design establishments with a total staff of over 40,000 persons. Every year geologists of the Ministry of Geology alone complete more than 20 million meters of core well drilling, over 3 million meters of petroleum and gas wells, and about 300,000 meters of various underground mining excavations. The geologists have at their disposal more than 10,000 drilling rigs.

The main purpose of recent Soviet mineral exploration has been to improve the regional distribution of resources for the production of major metals, all fuels, and many nonmetallic minerals. However, during the past 15 years, no increment in tin reserves has been achieved even in the Soviet Far East. Poor results were also reported in the growth of reserves of bauxite, lead, zinc, mercury, tungsten, molybdenum, antimony, and nickel (Kola Peninsula). According to the Ministry of Geology of the U.S.S.R., the quota for exploration of additional mineral reserves in the first half of 1980 was met by 117.4% for oil and gas condensate, 116.6% for iron ore, 143.7% for lead, 200% for zinc and tungsten, and 152% for phosphate.

In recent years, the effectiveness of prospecting and exploration has been reduced and the number of deposits transferred for mining has been reduced. Effectiveness has been especially low at Rudnyy Altay, Dzhungariya, Karatau, and Balkhash. The raw material base is especially poor at the Achisay, Balkhash, Tekeli, Belogorsk, and Kargayly polymetallic complexes, and all

gold mining enterprises of Kazakhstan. An improvement in geological prospecting in the Soviet Far East is expected as a result of the creation of the Soviet's Dalgeologiya Production Geological Association established in May in Khabarovsk on the base of the Far Eastern Territorial Geological Administration. The new organization is directly responsible to the Ministry of Geology of the U.S.S.R. Another production association, Yakutgeologiya, was also setup in May in the Far North. It will prospect for minerals in a vast region of the country adjacent to the Arctic Ocean. Exploration in Yakutia has been entrusted to 13 large prospecting expeditions.

There are shortages of bauxite, copper (Urals), nickel (Kola Peninsula), mercury (Ukraine), and lead (Rudnyy Altay and Kazakhstan). While there have been problems in improving the distribution of reserves, production has been increased from existing deposits. Good results were obtained in increasing the quantity and quality (by 50%) of copper-nickel reserves in the Norilsk area, where over 20 teams of geologists were employed in 1980.

Over 2,500 geological and geophysical teams are permanently employed in oil and gas exploration and about 2,200 exploration wells are completed each year, using 2,500 drilling rigs. In 1980, the target for oil and gas exploratory drilling by the Ministry of Geology was not met. The speed of drilling remained essentially at the 1976 level (387 meters per rig month). In 1980, Western Siberia continued to be the main target for Soviet oil and gas exploration, but the speed of drilling was low. The main causes of the low performance of drilling operations in West Siberia are the complex transport system for delivery of the basic materials, pipes and tools, and organizational deficiencies, and also the severe climatic conditions influencing the duration of all forms of operations. There is no incentive for deep drilling because quota fulfillment in the U.S.S.R. is calculated on the basis of the number of meters drilled, independent of depth. Exploration of oil and natural gas is to be extended in the next 5 years. There is to be intensive exploration in the European part of the country, in Siberia, and on the eastern coast of the Caspian Sea.

The search for oil at great depths of the Caspian Sea yielded its first result in January. A well drilled 84 meters deep yielded 200 tons of oil. It is planned to drill wells in water depths exceeding 150 meters. This is possible with new West European drilling rigs. Reportedly, the $110 million contract for assistance in oil exploration in the Caspian Sea went to a French consortium in March. A number of self-propelled platforms for geological prospecting in the Black Sea are to be constructed at the Kiev shipbuilding yard. The construction of the first vessel was almost finished in 1980. The first stage of drilling for oil and natural gas off Gdansk in the Baltic Sea, with the U.S.S.R., Poland, and the GDR participating (Petrobaltic), started in August and the first well was to be 3,000 meters deep. Soviet and Finnish specialists have discussed the possibility of Finnish firms taking part in the exploration of oilfields and gasfields in the northern continental shelf off the U.S.S.R.

Approximately 35,000 meters of exploratory wells have been drilled on the Sakhalin Island shelf with encouraging results. The Soviet Union has pledged to sell half of the oil produced to Japan in return for the Japanese assistance in drilling. With the signing of the Soviet-Vietnam agreement on cooperation in geological prospecting and extraction of oil and gas on the continental shelf off Southern Vietnam in July, the U.S.S.R. gained access to Vietnam's promising offshore oil and gas reserves. Under a Soviet-Brazilian agreement, Soviet geologists will be sent to Brazil to search for oil.

Soviet geologists are not well equipped with geophysical instrumentation, particularly with automated data acquisition and processing equipment. The main method of contouring deposits is still the preferred mechanical method, i.e., drilling wells and drifting mine workings. Expenditures on geophysical surveying of oil and gas accounted for 25% of the total exploration cost for these commodities. The U.S.S.R. is purchasing large quantities of oil equipment from Western suppliers as exploration of its "vast" oil and gas reserves continues. Offshore prospecting needs specialized geological and geophysical ships and floating drilling rigs, but domestic production of these is proceeding slowly.

Surveying of the Aktogaysk copper deposit in Kazakhstan and the Kholodnenskoye lead and zinc deposit in East Siberia was completed in 1980. The latter deposit is situated 50 kilometers from the BAR. Pre-

liminary exploration of the Betyuninsk iron ore deposit at the Urals was completed. The Soviet Union has reported the discovery of its third largest phosphate deposit in Estonia. Completion of detailed exploration of the Podal'skoye copper deposit in the Urals, and the Karabinskoye tungsten and Shalkiya lead-zinc deposits in Kazakhstan, as well as surveying of the Udokan copper deposit in East Siberia, were rescheduled for 1981. Completion of exploration of the Severogor-Blagodatskoye in the Urals, Belanovskoye in the Kremenchug region of the Ukraine, and Aleshinskoye (Kazakhstan) iron ore deposits were also rescheduled for 1981.

Prospecting was intensified for copper in the Urals, at the Udokan deposit in Chita Oblast', and in Central and Southern Kazakhstan. Prospecting for lead and zinc in the Rudnyy Altay region was conducted on areas adjacent to the Leninogorsk and Zyryanovsk complexes and at the Uchkulachsk deposit in Uzbek S.S.R. Tin prospecting was increased in the Yakut A.S.S.R., in the Khabarovsk Kray, in the Pamirs, and in other promising regions. Prospecting was also undertaken on the northern side of the Talnakh ore deposit at Norilsk, and the Trudovoye tin deposit in Kirgiziya. According to "Communist Tadzhikistana," the geological prospecting in Tadzhik S.S.R. will undoubtedly lead to the discovery of new commercial deposits of nonferrous and precious metals. The development of gold mining in the Republic supports this contention. Reorganization of the prospecting and development firm "Tadzhikzoloto" (Tadzhik gold) into production and development of a new mine and construction of new concentration plants has recently become necessary as a result of prospecting successes and the increased price of gold.

Exploration for oil and natural gas in the Anadyr area (Soviet Far East) is expected to increase sharply during the 1981-85 plan period. Also, according to an agreement, the U.S.S.R. will help Turkey in oil exploration and drilling.

Table 4.—Soviet mineral reserves in place in the A+B+C$_1$ categories [1]

(Thousand metric tons unless otherwise noted)

Commodity	A+B+C$_1$
METALS	
Bauxite, 26% to 62% alumina	65,000
Antimony, metal content	150
Arsenic, white (As_2O_3)	40
Beryllium, beryl, cobbed, 10% to 12% BeO	50
Bismuth, metal content	2.5
Cadmium, metal content	50
Chromium, chromite ore, 30% to 56% Cr_2O_3	60,000
Cobalt, metal content	100
Copper, metal content	40,000
Gold, metal content, thousand troy ounces	200,000
Iron ore, 38% iron [2]	60,200,000
Lead, metal content	16,000
Magnesium, metal content	2,800
Manganese ore, 23% to 26% Mn [2]	250,000
Mercury, metal content, 76 pound flasks	1,100,000
Molybdenum, metal content	200
Nickel, metal content	5,000
Platinum-group metals, content, thousand troy ounces	90,000
Silver, metal content, do	1,000,000
Tin, metal content	600
Titanium, TiO_2 content	10,000
Tungsten, metal content	150
Zinc, metal content	20,000
NONMETALS	
Asbestos	100,000
Barite	10,000
Cement [2]	27,720,000
Clays: Kaolin (including china clay)	80,000
Corundum, natural	150
Diamond:	
Gem, thousand carats	30,000
Industrial, do	120,000
Diatomite	10,000
Feldspar	8,000
Fluorspar	10,000
Phosphate rock: [2]	
Apatite; 16% P_2O_5	2,750,000
Sedimentary rock, 13% P_2O_5	2,700,000

See footnotes at end of table.

Table 4.—Soviet mineral reserves in place in the A+B+C$_1$ categories [1] —Continued

(Thousand metric tons unless otherwise noted)

Commodity	A+B+C$_1$
NONMETALS —Continued	
Graphite	3,000
Gypsum	5,000,000
Lime	2,000,000
Mica	1,000
Potash,[2] K_2O content	3,800,000
Salt, all types	1,300,000
Sulphur	500,000
Talc	15,000
MINERAL FUELS	
Coal:	
Bituminous and anthracite[2]	230,000,000
Lignite and brown coal[2]	190,000,000
Gas, natural million cubic meters[2]	29,000,000
Peat[2]	39,000,000
Oil shale[2]	163,200,000
Petroleum[2]	12,900,000

[1]Estimated except where otherwise noted.
[2]Reported in Soviet sources.

Construction.—The U.S.S.R. continues to experience difficulty in completing mineral industry projects on schedule owing to deficiencies in planning, inadequate coordination, and equipment and material shortages. The construction of new projects remained slow and expensive and material and labor force resources were frequently dispersed over a large number of projects, so that leadtimes were two to three times as long as specified by the U.S.S.R. State Construction Committee. The 10- to 15-year period required to develop a mine with a capacity of 1 million to 2 million tons per year contributed to disparities between the capacities of mines, concentration mills, and metallurgical plants in the iron and steel industry of Kazakhstan and many other projects. The practice of resorting to expedients resulted in great inefficiencies and prolonged delays in reaching design capacity. For example, in the majority of mines developed in the Donets Coal Basin during the 1971-75 period, the planned capacity goals had not yet been reached by a total of 12 million tons of coal per year.[25]

Construction of stainless steel production facilities at the Bekabad Plant in Uzbekistan started in 1974. By 1978, the facility was to have achieved 70% of total capacity, but actually it reached only 40% by the end of 1979. The first and second stages of the project cost 90 million rubles. The production cost of steel is 284 rubles per ton, while the price is set at 82 rubles per ton. There is great overuse of ore, energy, and material.[26] The volume of unused equipment at the ferrous industry construction projects is very large. Unused equipment increased by 70% in 1980 compared with that of 1975.[27] In the chemical industry, there is an enormous backlog of unfinished chemical plants purchased abroad, which are to form the backbone of Soviet fertilizer production. The idle time of construction equipment and trucks at practically all construction projects is considerable and chronic.[28] The attainment of designed capacity of rotary kilns in the cement industry takes from 5 to 12 years.[29]

New enterprises that became operational in the iron and steel industry included the first section of the first stage of the cold rolling mill with a capacity of 1 million tons per year of cold rolling sheet at Novolipetsk. Completion of the second section of the first stage at this plant was rescheduled for 1981. Construction of the "150" rolling mill, with an annual capacity of 0.4 million tons of wire at the Beloretsk complex in the Urals was completed in December. The No. 1 350-ton oxygen converter with a capacity of 2 million tons per year at the Cherepovets Plant was put into operation on December 31, 1980. About 16,000 workers were employed in the construction of the converter and oxygen plant in 1980, and the cost of construction for the year amounted to 206 million rubles.[30]

The 2-strand, 8-million-ton-per-year pelletizing plant at Krivoy Rog was commissioned in June. The plant was built by FRG's Lurgi Chemie and Huttentechnik GmbH. There are now three Lurgi pellet plants, with a total capacity of 14.3 million

tons per year, in operation or under construction in the U.S.S.R. At the Mikhaylov iron mining and concentration complex in Kursk Oblast', the No. 13 section of the concentrator, with a capacity of 0.8 million tons per year of concentrate (1.5 million tons of ore), was put into operation in December. New facilities for production of 1.7 million tons per year of iron concentrate at the Lebedi complex in the Belgorod Oblast' went onstream in August. The second stage of the No. 2 pelletizer plant, with an annual capacity of 3 million tons of iron pellets, at the Dneprovsk complex, was commissioned in November. The first stage of the Yubileynaya Mine at Krivoy Rog, with a total capacity of 4 million tons per year of crude iron, was commissioned on December 26, 1980. The fifth section of the Olenogorsk mining and concentration complex in Murmansk Oblast', with an annual capacity of 1,275,000 tons of iron concentrate, was commissioned in July. The total capacity of five sections is about 6 million tons of concentrate per year.

The sinking of the 620-meter-deep shaft at the Yakovlevo Mine in Belgorodsk Oblast' was completed in April and new facilities for the production of 2 million tons per year of iron sinter at the Cherepovets Plant went onstream in December.

In the nonferrous industry field , the following facilities were put into operation in 1980: The fourth (March) and fifth (December) potlines at the Regar (Tadzhik) aluminum plant, the first stage of the Nikolayev alumina plant, a new facility for production of anode copper at the Severonikel complex in Monchegorsk (Kola Peninsula), and a rolling mill at the Balkhash copper complex in Kazakhstan. New facilities also were put onstream at the Ust'-Kamenogorsk lead and zinc and the Irtysh chemical metallurgical complexes in Kazakhstan, and at the Dukat gold mining and concentration complex in the Soviet Far East. The Nadezhda tin mine at the Solnechnyy complex in Khabarovsk Kray was opened in May and the Glubokaya mercury mine at the Khaydarkan complex in Kirgiziya became operational in December. The first stage of the Molodezhnaya chromite mine, with a capacity of 0.8 million tons per year of crude ore, in Aktyubinsk Oblast', Kazakhstan, and a new manganese mine, with an annual capacity of 0.3 million tons of crude ore, at Chiautura Basin, Georgia, went into operation in 1980.

The second stage of the Kiyembay asbestos mining and concentration complex in the Orenburg Oblast' was put into operation in December. The design capacity of this stage is 250,000 tons per year, raising the complex's total capacity to 0.5 million tons per year. New facilities for production of sulfuric acid at the Kokhtla-Yarva mineral fertilizers plant (0.5 million tons per year) in Estonia and at the Gomel chemical plant in Belorussia went into operation; the equipment was manufactured in Poland.

The 1980 plan called for development of new and renovated underground and open pit mines for the production of about 16 million tons per year of raw coal and construction of new and the renovation of four coal washers of 16.3 million tons per year of raw coal. A State Commission accepted for operation in 1980 the following new coal production facilities in the Donets Basin: The first stages of the Zhadovskaya-Kapital'naya Mine with an annual capacity of 2.1 million tons of anthracite, the Sukhodol'skaya-Vostochnaya Mine with capacity of 1.2 million tons per year, and the Nagol'chanskaya Mine with designed capacity of 0.75 million tons per year. The No. 2 coal washer in the Karaganda Basin, with an annual capacity of 7.5 million tons of marketable coal, which has been under construction for 10 years, went onstream in April 1980. In Estonia, a new section at the October open pit mine, with a capacity of 0.9 million tons per year of oil shale, was put into production in December.

Several articles in the Soviet press[31] sharply criticized the pace of development of the Nerunga coal production complex in South Yakutia, from which exports of coking coal to Japan (on compensation basis) are to begin in 1983. There is a shortage of 4,000 workers (50% of the labor requirements) and the construction plan for 1979 was met by only 50%.

In 1980, 4,100 kilometers of pipelines were to be laid, but only part of the planned quota was constructed. The 192-kilometer Priobskaya crude oil pipeline in Siberia was completed in May and the 425-kilometer Samgori-Batumi in Transcaucasia was put into operation in November. The oil pipeline in the Caspian Sea, which connects the Neftyanyye Kamni offshore oilfield with the continent, has reached Zhiloy Island. The Soviet Union is having difficulties building petroleum refining and petrochemical industry projects. Construction of the

Tomsk petrochemical complex has been behind schedule for several years. In 1980, only the first stage of the Mazheykskiy primary oil refinery in the Lithuanian S.S.R. was put onstream in September.

The 1980 planned capital investment for development of the Soviet gas industry was set at 45 billion rubles. It was planned to construct 5,000 kilometers of gas pipelines and 29 compressor stations. The following gas pipelines were put into operation in 1980: The 200-kilometer Maykop-Sochi (January), 180-kilometer Vozey-Usinsk-Pechora (February), 70-kilometer Andizhan-Mayli-Say (July), 403-kilometer Shurtan-Syr Darya (November), Yevlakh-Nakhichevan in Azerbaydzhan (December), and a 150-kilometer stretch of the fourth string of the Siyaniye Severa gas pipeline between Urengoy, Ukhta, and Gayazovets (December).

During the 1976-80 period, about 50,000 kilometers of oil and gas pipelines, over 300 compressors, pumping stations, and gas-processing plants with an aggregate capacity of 15,600 million cubic meters per year were put into operation. Compared with the preceding 5-year period, the volume of building and assembly work for the construction of enterprises of the oil and gas industry has increased by 36%, while in Western Siberia it has risen by 130%.

The 1980 plan called for construction of 17 billion kilowatts of electrical generating capacities. The 600-megawatt Beloyarsk prototype fast breeder reactor went into operation in April. The reactor is the third unit in the plant, which also includes two pressure tube reactors with generating capacities of 100 megawatts and 200 megawatts.

The fifth reactor-VVER-1000, with a capacity of 1 million kilowatts, at the Voronezh nuclear powerplant was commissioned in June. The total capacity of the five reactors at this plant is 2.5 million kilowatts. The VVER-440 reactor with a capacity of 440 megawatts at the Rovenskaya nuclear powerplant was put into operation in 1980.

In 1979, the Soviet Union sank 200 shafts with a total length of 27,560 meters, of which 82 were coal shafts, 97 shafts were metallic, and 21 shafts were for the chemical and mineral fertilizer industries. Of the total length, 19,380 meters were vertical and 8,180 meters were inclined shafts. Construction of the BAR is 1.5 years behind schedule. The largest problem is a lack of labor. Labor turnover is 50% per annum.

The number of uncompleted projects in the construction industry has risen considerably in the last 10 years. The total volume of unfinished construction at the beginning of 1979 reached 85% of the annual level of capital investment instead of the 65% average according to established regulations. The above norm unfinished construction projects are valued at 23 billion rubles.[32] Many mines and plants are costing two to three times more than had been originally estimated.[33]

Additional production facilities, including new or expanded plants and renovation of existing units, are given in table 5.

Table 5.—U.S.S.R.: Additional or renovated production facilities

(Million tons)

Commodity	1976	1977	1978		1979		1980	
			Planned	Reported	Planned	Reported	Planned	Reported
Iron ore, crude	45.0	14.1	38.4	19.8	NA	NA	NA	NA
Coal and lignite, raw	12.6	17.4	26.6	26.0	30.0	19.3	16.0	15.0
Pig iron	2.25	0.6	2.4	2.2	NA	NA	NA	NA
Steel, raw	1.2	6.0	3.6	2.9	NA	NA	NA	NA
Mineral fertilizer (Soviet standard)	7.3	4.0	17.0	3.0	NA	15.8	10.97	9.9
Cement	1.85	4.2	NA	4.1	21.1	NA	NA	NA
Power (million kilowatts)	11.9	10.0	11.9	8.3	12.3	10.9	17.6	13.1

NA Not available.

PRODUCTION

A Soviet decree of April 1956 classifies all data on production capacity and production plans of nonferrous, precious, and rare metals and some nonmetallic enterprises as State secrets. Although the U.S.S.R. does not publish official statistics on many mineral commodities, information is available on most minerals. Published information on industrial development, however, provides some basis for estimating output of many other commodities. The increase in Soviet mineral production in 1980 was largely due

to additional capacity and labor rather than to productivity gains. The U.S.S.R. devotes one-fourth of its gross national product (GNP) to investment, compared with one-sixth in the United States. Total Soviet industrial production remains about one-half of that of the United States.

Reportedly, 70 elements were recovered in the U.S.S.R. In 1979, one-third of the total crude steel and 20% of nonferrous metals were produced from scrap. The maximum depth of underground coal production reached 1,150 meters in 1979, while the average depth was 430 meters. Many new plants and mines that were put into operation in the 1971-75 period produced at only 50% to 60% of their design capacity.[34] During the 1977-80 period, the Asian part of the country (east of the Urals) provided an increase of almost 100% of oil, natural gas, and aluminum, over 90% of raw coal and lignite, and about 80% of copper.

In 1980, the Russian Soviet Federated Socialist Republic (RSFSR) continued to rank first among the 15 Soviet Republics in mineral production and produced about 80% of the gold and silver, practically 100% of platinum-group metals, 90% of the petroleum, over 50% of the natural gas, more than half of the coal and steel, and about two-thirds of the electric power. While having only 3% of the territory of the U.S.S.R., the Urals produced a considerable portion of the industrial output of the Soviet Union. Steel and rolled ferrous metal products, pipe and metallurgical equipment, aluminum, copper, zinc, nickel, cobalt, gold, platinum, minor metals, asbestos, potassium, and various construction materials are produced in the Urals. The Urals are providing the Soviet economy with modern machinery and equipment, which currently extracts more than 70% of the oil and gas, produces 80% of the sinter, over 90% of the pig iron, 80% of the continuous cast slabs, 30% of the hot-rolled metal, all of the cold-rolled steel bars, and all of the freight car wheels.

The Ukraine occupied first place in output of coking coal, manganese and iron ore, and second place in natural gas. This Republic continued to provide about one-third of the total Soviet coal output, over 50% of iron ore, about 50% of the pig iron, 39% of the steel and rolled metal, over 75% of the manganese ores, about 20% of the natural gas, and nearly 50% of the metallurgical and electric engineering products. The Republic also produces a considerable share of the country's output of titanium, mercury, sulfur, and graphite. In 1980, this Republic had over 6,000 deposits of different minerals. Kazakhstan occupied third place in Soviet mineral production and was the leader both in reserves and in production of lead, zinc, copper, chromium, and cadmium. There was also considerable production of alumina, titanium, magnesium, gold, and silver. This Republic produced 30% of the total Soviet copper, 50% of the zinc, and over 70% of the lead.

The Soviet mineral industry is facing a number of technological problems, including declining ore grades, insufficient variety of flotation reagents, increasing ash and sulfur content in coal produced, and obsolete equipment. Because of low labor productivity, the labor force shortage is a major problem in the development of mineral industry despite the fact that Soviet miners are relatively well paid.

In 1980, raw steel output in the U.S.S.R. was lower than that in the preceding year. Bottlenecks in raw material, transport, and slowness in the introduction of sophisticated engineering and technology will hold back the development of the Soviet steel industry. During the 1976-80 5-year period, Soviet raw-coal production has fallen considerably behind schedule. In 1980, production fell to 716 million tons, 2.7 million tons less than in 1979, and 29 million tons short of the revised (84 million tons short of original) yearly goal. Daily production of natural gas at the Novyy Urengoy Field, the largest gasfield in the U.S.S.R., is 20 million cubic meters less than the planned target. The four ministries that are responsible for bringing the field onstream have failed to implement a program adopted in 1976 for development of this field. Only two of three gas-processing installations planned for 1978 and only one of three planned for 1979 were brought onstream. The plan for drilling is behind schedule. It was planned to raise the 1975 volume of primary oil processing 25% to 30% by 1980. Actually, during the 4-year period (1976-79), primary oil processing increased only by 15%.

Although about 400 different minerals are mined and processed in the U.S.S.R., insufficient attention is paid to the comprehensive use of mineral resources. For example, at the Zyryan lead and zinc complex only 8 out of 16 main components of the ore are extracted; the remainder go to waste. Generally, only the main metals in a specific ore type are extracted and most of the

byproducts (zinc, cobalt, silver, barium, etc.) are discarded. Losses of byproducts amount to more than half of the total value of the ores. About 31% of all beneficiation and metallurgical plants of the Soviet nonferrous industry did not meet planned targets for recovery of copper, lead, zinc, tin, and tungsten in 1979. The largest losses of metals were permitted by the concentrators of the Almalyk (Uzbekistan) and Balkhash (Kazakhstan) metallurgical complexes, by the Tekely and Achisay (Kazakhstan) mining and concentration complexes, as well as by the Chimkent lead plant, the Ust'-Kamenogorsk (Kazakhstan) lead-zinc metallurgical complex, and by the production association Nikel complex (Kola Peninsula).[35]

The 1979 planned quotas for Soviet production of alumina, aluminum, lead, zinc, nickel, sulfuric acid, and others were not met because of shortages of raw materials, supplies, fuel, power, and transportation problems, as well as nonfulfillment of planned targets for construction of new facilities.[36] Nonferrous metallurgy of East Kazakhstan decreased production of metals during the 1976-80 period.[37] The Dzhezkazgan, Achisay, Irtysh, and Tekel complexes in Kazakhstan did not meet production quotas for 1979.[38] Unsatisfactory performance of the Chimkent lead (Kazakhstan), "Elektrotsink" zinc, Kirovobad (Azerbaydzhan), the Ural'sk aluminum, and Krasnoural'sk (the Urals) copper plants was reported in 1979 and 1980.[39] In 1979, production targets for output of nonferrous ores were not met at the mines of Dzhezkazgan (Kazakhstan), Almalyk (Uzbekistan), Krasnouralsk (the Urals), and the Irtysh (Kazakhstan) metallurgical complexes as well as at Tyrny-Auz (North Caucasus), Achisay, and Karagaylinsk (Kazakhstan) mining and concentration complexes.[40]

The lead-zinc industry in Rudnyy Altay (East Kazakhstan) is facing serious problems as the high-grade polymetallic deposits near depletion. Lower-grade ores were used recently, but industry lacks the capacity to develop and process them. During the 1976-79 period, the Leninogorsk and Zyryanovsk lead-zinc metallurgical complexes processed about 3.5 million tons of polymetallic ores with a total lead and zinc content of 0.5% to 0.6%.[41] The slow development of new mines in Kazakhstan forced the nonferrous enterprises of this Republic to process old slags of lead shaft smelting to recover lead and zinc.[42] The Dzhezkazgan and Balkhash complexes in Kazakhstan have experienced shortages of copper ore for a long time.[43] The old industrial central and southern regions of the Urals were beginning to experience shortages of copper, iron, and other ores in 1980. Some enterprises at these areas began to operate on raw materials transported from other regions.[44]

The quality of Soviet metal is low. Ferrous metallurgy is slowly reorganizing for the production of economical shapes. Of 140 effective rolled products, which according to the 1976-80 5-year plan should be produced for the needs of the machine-building industry, more than one-half were not produced. The consumption of metal for many kinds of machines is up to 50% greater in the Soviet Union than in the West. The main reason for this lag is inferiority of the grades and inadequate strength of the rolled products. When the needed grade is not available, a large piece is used.[45] About 80% of the accidents that occurred in 1979 breaks were caused by pipe breaks during the operation of the main gas pipelines. The main cause of accidents is external corrosion of the gas pipeline metal.[46] The quality of steel produced is low; consequently, protection from corrosion is also poor, resulting in losses of 15 million tons of steel annually.[47] Because of shortages and poor quality of pipe metal, the country is buying large quantities of pipe from Japan, the FRG, and other West European countries.

The official average ash content of coal shipped to consumers increased from 21.6% in 1965 to 23.9% in 1979,[48] but the actual ash content is much greater. For example, the discrepancy between the Shaturskaya thermal powerplant and the Dubrovskaya underground mine in appraisal of the ash content of the very same batch of fuel reached 15% to 17%. The Partizan underground mine shows in its documents an ash content of 39% to 40%, while actually it is often 61% to 62%.[49] Izvestiya[50] said that one of the reasons powerplants were not receiving sufficient coal was the poor quality of fuel. Mine operators were not directly concerned with supplying powerplants with high-quality fuel.

There is a vast labor force at work in full-quality inspection. About 17,000 people are employed in the quality administrations Department of Technical Control and chemical laboratories of the U.S.S.R. Ministry of Coal Industry mines alone. U.S.S.R. Gossnab (State Supply) has more than 800 inspectors who specialized in coal. More than

2,000 laboratory and claim workers stand guard over U.S.S.R. Minenergo (U.S.S.R. Power Ministry) fuel interests, and the share of guardians grows constantly. At one of the Ekibastuz's open pit mines, 227 people for mining coal and 217 people for taking samples and monitoring are employed. There is almost one observer for each miner.[51]

Many cement plants have produced low-quality products for a long period of time, resulting in overconsumption of cement in construction.[52] There is a small amount of good-quality products produced by the enterprises of the U.S.S.R. Ministry of Coal Industry, the Ministry of Ferrous Metallurgy, the Ministry of Nonferrous Industry, the Ministry of Construction Materials, and the Ministries of Machine Building.[53]

Losses of minerals during mining, processing, and extraction are large. Furthermore, the valuable byproducts are not always used and they are dumped as waste, thus depriving the economy of extra raw materials and contributing towards the pollution of the environment. Many enterprises of machine-building ministries are continuing to produce heavy equipment and machinery, a result of which the coefficient of metal utilization is low. The rolled metal is produced in tonnage, not in accordance with its purpose, it is stored badly, and it is squandered.[54] According to Soviet sources,[55] annual losses of metal in the technology of its production, overconsumption in machine-building, and in repair of equipment and machines amounted to 42.2 billion rubles. The losses of cement amounted to 16.5 million tons per year. Transportation of cement alone resulted in losses that are 1,100% to 1,200% higher than permitted by regulations.[56]

There is a shortage of metal in the country, which is becoming more acute each year. Among the main causes of the metal shortage are the inefficient planning (production in tons), shortage of new modern facilities, and poor product quality. Despite the fact that metal output is increasing, the volume of production in the economical categories is not meeting the national economy's requirements. This applies particularly to structural sheet, rolled metal with anticorrosive coatings, a number of types of low-alloy steel, heat-toughened rolled metal, and high-precision sections. Powder metallurgy is developing slowly. The Ministry of Nonferrous Metallurgy is failing to supply industry and construction with sufficient volumes of many types of nonferrous metal products, particularly rolled aluminum, and high-strength and corrosion-resistant alloys which are effective substitutes for ferrous metals.[57]

Builders are constantly complaining of a shortage of material resources. This is true, but at the same time, more than 5 million tons of ferrous rolled products, almost 24 million tons of cement, and more than 12 million cubic meters of timber are frozen above normal at many enterprises.[58]

Citing the chemical industry's importance for the national economy, especially for the production of mineral fertilizers, the Presidium of the U.S.S.R. Supreme Soviet in November divided the All-Union Ministry of the Chemical Industry into two all-union ministries: The Ministry of the Chemical Industry and the Ministry for the Production of Mineral Fertilizers.

Table 6.—U.S.S.R.: Estimated[1] production of mineral commodities[2]

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Ore and concentrate:					
Bauxite, 26% to 57% alumina	4,500	4,600	4,600	4,600	4,600
Nepheline concentrate, 25% to 30% alumina	2,400	2,500	2,500	2,500	2,500
Alunite ore, 16% to 18% alumina	600	600	600	600	600
Alumina	2,500	2,600	2,600	2,600	2,700
Metal, smelter:					
Primary	1,600	1,640	1,670	r1,750	1,790
Secondary	150	150	150	150	150
Antimony, mine output, recoverable metal content—tons	7,700	7,900	7,900	8,200	8,200
Arsenic, white (As_2O_3)—do	7,400	7,500	7,600	7,700	7,700
Beryllium: Beryl, cobbed, 10% to 20% BeO—do	1,650	1,700	1,750	1,800	1,800
Bismuth, mine output, recoverable metal content—do	60	65	70	72	72
Cadmium metal, smelter—do	2,700	2,750	2,800	2,850	2,850
Chromium: Chromite ore, 30% to 56% Cr_2O_3	2,120	2,180	2,300	2,400	2,450

See footnotes at end of table.

Table 6.—U.S.S.R.: Estimated[1] production of mineral commodities[2] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Cobalt:					
Mine output, recoverable metal content _tons	1,800	1,900	1,950	2,000	2,150
Metal, smelter _____do	[r]3,300	[r]3,400	[r]3,550	[r]3,600	3,650
Copper:					
Ore:					
Gross weight, 0.5% to 2% Cu	124,000	124,450	125,000	125,000	126,000
Metal content, recoverable	800	830	865	885	900
Metal:					
Blister:					
Primary	840	850	865	885	905
Secondary	80	85	90	95	95
Refined:					
Primary	760	790	810	830	845
Secondary	160	160	170	170	170
Gold, mine output, metal content thousand troy ounces	7,700	7,850	8,000	8,160	8,300
Iron and steel:					
Iron ore, 55% to 63% Fe[3]	[r]241,108	[r]241,851	[r]246,251	[r]241,738	245,000
Agglomerated products:[4]					
Sinter	153,251	158,195	159,564	57,427	[e]159,000
Pellets	31,398	36,170	45,005	44,012	[e]45,000
Metal:					
Pig iron and blast-furnace ferroalloys:					
Pig iron for steelmaking	96,033	97,841	100,875	[r]99,000	99,500
Foundry pig iron	8,371	8,552	8,817	9,000	9,000
Spiegeleisen	102	100	100	100	100
Ferromanganese	850	850	880	[r]868	870
Other blast-furnace ferroalloys	28	25	30	30	30
Total[4]	105,384	107,368	110,702	108,998	109,500
Electric-furnace ferroalloys	1,150	1,167	1,207	1,257	1,300
Crude steel:					
Ingots	135,704	137,440	141,273	139,000	137,800
Steel for castings	9,121	9,238	10,163	10,099	10,200
Total[4]	144,825	146,678	151,436	[3]149,099	[3]148,000
Semimanufactures:[4]					
Sections	38,084	38,697	39,842	38,716	NA
Wire rod	8,348	8,349	8,231	7,989	NA
Pipe stock	5,872	5,845	6,071	6,040	NA
Tubes from ingots	1,688	1,811	1,862	1,880	NA
Plates and sheets:					
More than 5 millimeters thick	13,640	13,852	14,076	13,592	NA
Other	18,929	18,907	20,076	19,682	NA
Total	32,569	32,759	34,152	33,274	NA
Strip	10,603	10,714	11,109	11,475	NA
Railroad track material	3,945	3,943	4,143	3,971	NA
Wheels, tires, axles	1,190	1,118	1,125	1,068	NA
Unspecified shapes for sale	745	631	671	633	NA
Other and unspecified	69	68	71	71	NA
Total	103,113	103,935	107,277	105,117	[3]103,000
Selected end products:[5]					
Total pipes and tubes[3]	16,806	17,021	17,553	18,185	[3]18,200
Cold-rolled sheet[4]	6,943	7,054	7,017	7,019	NA
Tinplate	612	612	600	600	NA
Galvanized sheet	660	660	700	700	NA
Electrical sheet[4]	1,151	1,154	1,173	1,152	NA
Cold-reduced strip[4]	435	431	471	477	NA
Wire, plain	3,850	3,850	3,600	3,500	NA
Lead:					
Mine output, recoverable metal content	500	510	520	525	525
Metal, smelter:					
Primary	500	510	520	525	525
Secondary	100	100	100	100	100
Magnesium metal, including secondary	63	65	70	72	75
Manganese ore, gross weight[3]	8,636	8,595	9,057	10,244	10,250
Mercury metal, including secondary 76-pound flasks	56,000	58,000	60,000	61,000	62,000
Molybdenum, mine output, metal content _tons	9,350	9,700	9,900	10,200	10,400

See footnotes at end of table.

Table 6.—U.S.S.R.: Estimated[1] production of mineral commodities[2] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS —Continued					
Nickel:					
Mine output, metal content	[r]141	[r]144	148	152	154
Metal, smelter	[r]161	[r]164	168	172	174
Platinum, mine output, metal content thousand troy ounces	[r]3,050	[r]3,100	[r]3,150	3,200	3,250
Silver metal, including secondary do.	44,000	45,000	46,000	46,000	46,000
Tin:					
Mine output, recoverable metal content tons	31,000	33,000	34,000	35,000	36,000
Metal, smelter:					
Primary do.	31,000	33,000	34,000	35,000	36,000
Secondary do.	11,000	12,000	12,000	12,000	12,000
Titanium:					
Concentrates:					
Ilmenite do.	380,000	400,000	410,000	410,000	420,000
Rutile do.	27,000	27,000	30,000	30,000	30,000
Metal do.	32,000	[r]34,000	[r]35,000	[r]36,000	37,000
Tungsten concentrates, metal content do.	8,000	8,200	8,500	8,700	8,700
Vanadium do.	8,000	9,000	9,500	10,000	10,000
Zinc:					
Mine output, recoverable metal content	720	735	770	770	785
Metal:					
Primary	720	735	770	770	785
Secondary	80	80	80	80	80
NONMETALS					
Asbestos	[r]1,850	[r]1,900	[r]1,945	[r]2,020	2,150
Barite	400	450	475	500	500
Boron minerals and compounds:					
Gross weight	180	180	200	200	200
B_2O_3 content	90	90	100	100	100
Cement, hydraulic[3]	124,246	[r]127,056	[r]126,956	[r]123,019	125,000
Clays: Kaolin (including china clay)	2,200	2,300	2,400	2,500	2,500
Corundum, natural tons	7,500	8,000	8,500	8,500	8,600
Diamond:					
Gem thousand carats	2,000	2,100	2,150	2,200	2,250
Industrial do.	7,900	8,200	8,400	8,500	8,600
Total do.	9,900	10,300	10,550	10,700	10,850
Diatomite	[r]428	430	440	450	450
Feldspar	280	290	300	310	310
Fluorspar	490	500	510	520	520
Graphite	95	95	100	100	100
Gypsum	5,000	5,200	5,300	5,400	5,400
Iodine	2	2	2	2	2
Lithium minerals, not further specified	45	50	50	50	55
Lime, dead-burned	23,000	23,500	23,500	24,000	24,500
Magnesite:					
Crude	3,600	3,700	3,800	3,900	4,000
Marketable product	1,800	1,850	1,900	1,950	2,000
Mica	43	44	45	46	46
Nitrogen, N content of ammonia	10,090	10,744	11,300	12,200	[e]12,400
Perlite	330	340	360	360	350
Phosphate rock:					
Crude ore:					
Apatite, 17.7% P_2O_5	37,000	41,000	42,300	44,700	45,000
Sedimentary rock, 13% P_2O_5	17,000	17,500	18,000	18,500	19,000
Total	54,000	58,500	60,300	63,200	64,000
Concentrate:					
Apatite, 39.4% P_2O_5	15,400	15,500	15,962	16,330	16,500
Sedimentary rock, 19% to 25% P_2O_5	8,500	8,750	9,000	9,250	9,500
Total	23,900	24,250	24,962	25,580	26,000
Potash, K_2O equivalent[3]	8,310	8,347	8,193	6,635	[e]8,000
Pyrite, gross weight	7,000	7,000	7,400	7,400	7,500
Salt, all types	14,200	14,300	14,500	14,300	14,500
Sodium compounds, n.e.s.:					
Sodium carbonate[3]	4,842	[r]4,876	[r]4,858	4,782	[e]4,800
Sodium sulfate:					
Natural	310	320	330	340	350
Manufactured	220	230	240	240	250
Sulfur:					
Frasch	500	500	800	800	900

See footnotes at end of table.

Table 6.—U.S.S.R.: Estimated[1] production of mineral commodities[2] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Sulfur —Continued					
Other native	2,200	2,400	2,700	2,700	2,800
S content of pyrite	3,300	3,500	3,500	3,500	3,550
Byproduct:					
Of coal	40	40	40	40	40
Of metallurgy	2,040	2,180	2,210	2,210	2,310
Of natural gas	870	920	1,100	1,100	1,100
Of petroleum	190	200	200	200	200
Total	9,140	9,740	10,550	10,550	10,900
Talc	440	450	470	480	490
MINERAL FUELS AND RELATED MATERIALS					
Coal:[6]					
Anthracite	77,739	79,000	79,000	79,000	79,000
Bituminous coal:					
Coking	183,000	185,000	185,000	185,000	185,000
Other (not further specified)	287,279	291,000	293,000	289,960	288,000
Total "hard" coal	548,018	555,000	557,000	553,960	552,000
Lignite and brown coal	163,504	167,025	166,484	164,704	164,000
Coke: Coke oven, beehive, breeze, gas coke	84,400	86,000	86,400	86,000	86,000
Fuel briquets:					
From anthracite and bituminous coal	1,350	715	700	700	700
From lignite and brown coal	7,204	7,840	7,302	7,300	6,800
Total	8,554	8,555	8,002	8,000	7,500
Gas, natural:					
Gross—million cubic feet	11,950,000	12,884,000	13,852,000	[3]14,370,000	15,374,000
Marketed:					
As reported[3]—million cubic meters	320,953	346,003	372,194	406,597	435,00
Converted[3]—million cubic feet	11,334,295	12,218,923	13,143,845	14,358,770	15,361,807
Peat:					
Agricultural use	131,600	132,000	132,000	132,000	132,000
Fuel use	60,000	60,000	60,000	60,000	60,000
Oil shale	33,000	33,500	34,000	34,500	35,000
Petroleum:					
Crude:					
As reported, gravimetric units[3]	519,677	545,799	571,531	586,000	603,000
Converted, volumetric units thousand 42-gallon barrels	3,819,626	[r]4,011,623	4,200,753	4,307,100	4,432,050
Refinery products[7 8]	383,190	392,722	403,048	[e]415,000	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Unless otherwise specified.

[2]Includes data available through Sept 4, 1981.

[3]Reported in Soviet sources.

[4]1976-79 data are from: United Nations Economic Commission for Europe. Annual Bulletin of Steel Statistics for Europe 1979, New York. V. 7, 1980, p. 21.

[5]Produced from semimanufactures listed above and possibly also from similar imported semimanufactures. Therefore, these data are not additive to total semimanufactures listed.

[6]Run-of-mine coal. The average ash content of coal shipped from mines was 20.2%, and the average calorific value was slightly more than 5,000 kilocalories per kilogram (9,000 Btu's per pound) in 1977.

[7]Not distributed by type and therefore not suitable for conversion to volumetric units. Data include all energy products and some nonenergy products as well as refinery fuel and exclude petrochemical feedstocks, paraffin, petroleum coke, white spirit, unspecified minor nonenergy products, and refinery losses.

[8]1976-78 data are from: United Nations. World Energy Supplies 1973-78, New York. Ser. J, No. 22, 1979, p. 148.

Mine Safety and Health.—While the U.S.S.R. does not publish data on injuries in the mineral industry, available Soviet information revealed that there were many fatal injuries in 1980. In 1978, fatal injuries occurred at one-third of the Donets coal mines. The February 22, 1978, Pravda (for the first time) indicated that a major accident occurred at the Sokuskaya coal mine of the Karaganda Basin; resulting in an unspecified number of deaths. The second major coal mine disaster reported by the U.S.S.R. was at the Molodogvardeyskaya coal mine in the Donets Basin that occurred on August 10, 1979. The third reported major coal mine disaster took place at the Gorskaya Mine, also in the Donets Basin, on April 26, 1980. No casualty figures have been disclosed but it is thought that the loss of life was considerable.

In 1978, the number of fatal injuries increased in coal mines at the following coal production associations: Krasnoarmeyskugol', Makeyevugol', Ukrshakhtstroy, Ukrzapadugol', Donetskugol', Shakhtersk, Anthracit in the Ukraine, Gruzugol', Kizelu-

gol', Primorskugol', and Yuzhkuzbassugol'. In 1979, the number of injuries in the nonferrous industry increased at the enterprises of the "Armzoloto" production association, "Svinetsstroy" and Boksitostroy" trusts, at the Tyrny-Auz metallurgical complex, as well as at the Mikhaylovskiy and Lebedinskiy mining and concentration complexes of the ferrous industry. In 1979, a high level of injuries took place at the following oil production associations: Permaneft, Komineft', and Yugansknefteqaz.[59]

During 1980, the greatest level of traumatism was allowed at a number of coal mines controlled by management of the Voroshilovgrad, Kuznetsk, Karaganda, and Sakhalin safety districts. An inadmissible situation has arisen during the operation of hoisting cranes at many construction projects of ferrous and nonferrous metallurgy enterprises. At some mining enterprises work is conducted with a large number of long-standing infractions. Operational startup of units and enterprises with substantial incompletions of safety measures are occurring. The workers are sent for underground work in potentially dangerous areas, where safety violations have not been abolished.[60] The level of fatal injuries at the enterprises of the U.S.S.R. Ministry of Geology continued to be high. There were many violations of safety regulations at many exploration projects.[61] It has been established by an inspection that fuel accidents have been covered up, thus preventing these cases from being investigated by special commissions.[62]

There was a high rate of injury in many mines that resulted from mine management neglect, inadequate safety conditions, and violations of safety regulations and labor laws to increase production. The number of fatal accidents at underground mines continued to be high, especially from roof caving, mainly due to the shortages of props.[63] For example, requirements for prop shipments to the Karaganda coal basin were only 41% in 1979 and 48% in the first quarter of 1980. These resulted in shortages of props in the amount of 100,000 cubic meters in 1979 and 34,700 cubic meters in the first quarter of 1980.[64] The staff of the Makeyevka Safety Institute after a study of the work at 35 production faces (longwalls), established that because of shortages of support material in 29 faces, supporting had been violated. Inspections show that at many coal mines of the Donets Basin, very little attention is paid to full and correct supporting of production and development faces. Inspections also show that many longwalls are insufficiently provided with support material.[65]

The amount of workings at coal mines that are not in accord with safety regulations are large. On January 1, 1979, it was 29.9% at production association Artemugol, 25.5% at Pervomayskugol', and 19.1% at Ordzhenikidze.[66] At a number of coal mines, significant shortcomings of fire-prevention measures are allowed. According to a Soviet source,[67] 84 kilometers of mine workings that are supported with wooden props, and 85.3 kilometers of air pipelines do not correspond with safety regulations and standard requirements. Many coal mines are not equipped with fire extinguishers, fire hoses, etc.[68]

The accumulation of dust at work sites in underground mines in the Soviet Union is high and often exceeds the sanitary standard. The neglect of proper dust control at many mines resulted in unhealthy working conditions. The replacement of old and wornout ventilators have been proceeding slowly. At many coal mines the dust content in the air exceeds the maximum allowable concentration. During the inspection of 100 longwalls at mines of the Ministry of the Coal Industry of the Ukrainian S.S.R., it was determined that in 15% of production faces dust suppression equipment was idle and 55% of the longwalls' water dust suppression was inadequate.[69]

The lighting at the underground haulage of many coal mines is only from 8.6% to 44.5% of the sanitary standard. In 1980, the supply of lamps to Donbass coal miners was more than 60,000 lamps short of the requirement, and this was reason for delaying fulfillment of the annual production quota. At the Abakum Mine, almost a third of the underground miners did not have lamps and had to borrow lamps belonging to miners who worked on other shifts. The mine has 3,500 miners and are short 1,000 lamps. Moreover, the quality of the lamps that are supplied has deteriorated.[70]

According to "Labor,"[71] the real reason why mining in the Soviet Union is very hazardous is that "...production quotas are becoming not just highly demanding, but excessively so." According to the first secretary of the Komi Oblast' Party Committee, I.P. Morozov,[72] "the target for coal output in the Komi A.S.S.R. exceeds the mines potential for production." The miners are unable

to cope with such quotas, even though they are compelled to work on most of their days off.[73]

MINERAL TRANSPORTATION

The railroad accounted for more than half of all the freight turnover in 1980. The changes in the Soviet freight turnover by type of transportation, over the last 20 years is shown in table 7.

Table 7.—U.S.S.R.: Soviet transporation statistics in percent

Type of transportation	1960	1965	1970	1975	1980
Railway	79.4	69.0	63.1	59.2	50.4
River	5.2	4.7	4.4	4.0	3.7
Marine	6.9	13.8	16.6	13.4	12.5
Oil pipeline	2.7	5.2	7.1	12.1	18.0
Gas pipeline	.6	2.2	3.2	5.1	9.1
Automobile	5.2	5.1	5.6	6.2	6.3
Total	100.0	100.0	100.0	100.0	100.0

Source: Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 48, November 1980, p. 10.

About 90% of 1980 mineral production was shipped by rail. Coal is the most important commodity transported by rail, contributing 20% of the total shipping volume, followed by petroleum with 15%. The performance of the railways, which are essential to the development of all sectors of the Soviet economy, appears to have declined substantially during the past 5-year period. Since 1976, average speeds have dropped by 2.4 kilometers per hour and the average distance covered by a locomotive within a 24-hour period has fallen by 60.5 kilometers. The figures for electrified lines alone are even worse-falls of 4.4 and 97.7 kilometers per hour.[74]

Cross hauling and the irrational transportation of coal, coke, ore, oil, timber, building materials, and other bulk loads have reached gigantic proportions. The Soviet Rail Transportation Research Institute has estimated that elimination of irrational freight movements could reduce transportation costs by between 400 million and 500 million rubles per year and at the same time make it possible to deliver an additional 150 million tons of freight to its destination.[75]

Apart from crosshauling, an enormous amount of useless deadweight is transported around the country. For example, if the coal industry made a better job of washing its output, the railroad would be relieved of conveying between 20 million and 25 million tons of rock. Between 35% and 40% more freight cars are required to transport undressed logs than would be the case with sawed timber. About 11 million tons of mineral fertilizers, with a useful content of only 20%—half the acceptable standard—are also dispatched by rail each year.[76]

Another factor that directly contributes to the burden on the railroad system is the tendency, for economic reasons, to concentrate the manufacture of certain industrial products in one geographic location. Very often, the high costs of transportation that result more than overweigh any savings in the prime cost of production.[77]

The growth of coal mining in the U.S.S.R. is being accompanied by a deterioration of its quality. Some lumps reach the meter size when the permissible standard is 30 centimeters. The moisture, waste rock, sulfur, and ash content in the coal shipped is rising. During the past 10 years, the shipment of such low-quality products to power-generating plants alone increased by 60 million tons per year. Tens of thousands of railroad cars are required daily for coal hauling. Coal trains that travel from the eastern regions to the European part of the country are often loaded with as much as 40% waste rock and moisture. This means that two-fifths of the rolling stock is used irrationally. In the winter, an excessive moisture in coal causes it to freeze during transportation into monolith. It cannot be unloaded, therefore, a crusher is required. Idle time is increased and cars damaged during unloading have to be sent for repair prematurely. The high content in the coal of ash, sulfur, and other impurities accelerates wear on the power-engineering equipment and even leads to breakdowns. The powerplants have to create new equipment to use poor-quality coal and lignite.[78]

During the railroad transportation, each railroad car loses from 5 to 10 tons of coal. The coal sifts through the holes and is blown upward by tachind.[79] Each time a frost occurs hundreds and thousands of railroad cars arrive at coal mines with large

remnants of frozen coal; the latter is thrown outside and turns into debris.[80] More than 40,000 tons of iron pellets produced by the Mikhaylovskiy mining and concentration complex are lost during railroad transportation each year.[81]

There is cross-hauling of coal on Central, Ukraine, West Siberian, and other railroads. Millions of tons are sent each year from Kuzbass (4,000 kilometers) to various parts of the Ukraine. Here it is made into coke and then returned to its native districts. As a result, the railroads on this route are constantly overloaded. Millions of tons of coking coal from the Donets Basin (Ukraine) travels in the opposite direction. During the last 4-year period, the growth in average distance for coal hauling by rail increased by 98 kilometers. During this period, coal transport cost customers 180 million rubles more than for former distances. The amount of work done by the railroads increased 75.5 million ton-kilometers. For the national economy this means the loss of a real possibility for hauling an additional 46.5 million tons of freight.[82] It frequently happens that an empty car arrives at a mine with broken wooden sheathing, bent guard doors, and badly cut hatches. Therefore, coal is lost through these cracks during transportation.[83] Millions of tons of iron ore are transported from the Kursk region to the Urals each year.[84]

During the 1976-80 period, 3,300 kilometers of new railway lines and more than 3,000 kilometers of second track were commissioned. On January 1, 1980, the total length of Soviet railways was 141,000 kilometers; 42,400 kilometers of track were electrified. By the end of 1980, 2,100 kilometers of the planned 3,500 kilometers of track were laid at the BAR. It is planned to put 760 kilometers of new line into operation, to electrify 1,000 kilometers of track, and to equip over 2,000 kilometers with automatic signaling systems in 1981. The plan calls for construction of not less than 3,600 kilometers of new railway lines during the 1981-85 period.

By January 1, 1981, the U.S.S.R. Ministry of the Merchant Marine had 1,748 ships of 18.6 million deadweight tons in aggregate. There were 1,428 dry-cargo vessels (11 million deadweight tons), 310 tankers (6.5 million deadweight tons), and 10 combined dry-cargo ships and tankers (1.1 million deadweight tons). The tanker fleet has six vessels of the "Krym" class (150,000 deadweight tons). A 15,000-ton-capacity tanker, Sovetskaya neft, was constructed in 1980. It is the sixth Soviet tanker with the same capacity, but no more orders for such tankers have been placed. Soviet shipping lines employ mainly tankers of 20,000 to 40,000 deadweight tons. During the 1976-80 period, the fleet was augmented by new ships of 4.26 million deadweight tons in aggregate. In the course of the 5 years, a considerable number of old ships were written off. There was an effective increase of 5% in the deadweight tonnage of the fleet since the beginning of 1976.

The U.S.S.R. has the sixth largest merchant fleet in the world. The Soviet fleet is increasing by about 1 million deadweight tons per year. During the 1981-85 period, Czechoslovakia is to supply the Soviet Union with more than 90 vessels: Dry-cargo river-sea vessels, bucket-ladder dredges, and floating suction dredges.

The first stage of the Vostochnyy port east of Vladivostok, which has been constructed with Japanese assistance, can handle vessels up to 100,000 deadweight tons, although ships of only 20,000 deadweight tons are being used at present. Japanese steel companies received about 2 million tons of coal through this port in 1980. The second stage of the Vostochnyy port is to be built, again with Japanese assistance, in the 1981-85 period and will comprise a group of container terminals, the second stage of a coal-handling section, wharves for general cargo, wharves to handle grains, and various other projects.

TRADE

Soviet foreign trade is a state monopoly and is administered by the Ministry of Foreign Trade, operating through more than 70 foreign trade organizations. Political objectives exert a strong, and often determining, influence on foreign trade. The Soviet Union trades with 130 countries and in 115 cases the trade is based on interstate agreements. The trade continues to be orientated toward imports of large quantities of Western industrial machinery and technology (including complete industrial plants) and substantial grain purchases. The Soviets rely heavily on both foreign Government-backed and commercial credits to finance the increasing foreign

currency deficit. Exports of minerals help pay for these imports.

In 1980, Soviet foreign trade turnover (exports plus imports) increased by 11.7% compared with that of 1979, reaching 94,100 million rubles. The increase in trade turnover resulted from a slight increase in physical volume and a substantial rise in foreign trade prices for a number of export and import goods, particularly oil and other energy sources. Soviet foreign trade by groups of countries is presented in table 8.

Table 8.—U.S.S.R.: Soviet foreign trade in 1975, 1978, 1979, and 1980

(Million rubles)

	1975	1978	1979	1980
Whole world:				
Turnover	50,700	70,200	80,300	94,100
Exports	24,000	35,700	42,400	49,600
Imports	26,700	34,500	37,900	44,500
Socialist countries:				
Total	28,600	42,000	45,100	50,600
Exports	14,600	21,300	23,600	26,900
Imports	14,000	20,700	21,500	23,700
Of which CMEA members:				
Total	26,300	39,100	41,600	45,700
Exports	13,400	19,800	21,700	24,300
Imports	12,900	19,300	19,900	21,400
Western industralized countries:				
Total	15,800	19,700	25,700	31,500
Exports	6,100	8,700	12,500	15,800
Imports	9,700	11,000	13,200	15,700
Less developed countries:				
Total	6,300	8,500	9,500	12,000
Exports	3,300	5,700	6,300	6,900
Imports	3,000	2,800	3,200	5,100

Sources: Vneshnyaya torgovlys S.S.S.R. (Foreign Trade of the U.S.S.R.) 1978, and Ekonomicheskaya Gazeta (Economic Gazette), Moscow. No. 13, March 1981, pp. 21-22.

Soviet trade turnover with Western developed countries increased by 12.3% compared with that of 1979, chiefly owing to the sharp increases in prices. These countries' share of U.S.S.R. foreign trade turnover rose from 31.8% in 1979 to 33.5% in 1980.

During 1980, the volume of total official Soviet trade with leading Western developed countries, in million rubles, is shown in the following tabulation:

Country	1975	1979	1980
Germany, Federal Republic of	2,800	4,200	5,800
Finland	1,800	2,600	3,900
France	1,300	2,600	3,700
Italy	1,400	2,200	3,000
Japan	1,900	2,600	2,700
United Kingdom	1,000	1,900	1,800
United States	1,600	2,800	1,500
Netherlands	500	1,100	1,400
Belgium	500	800	1,200
Austria	400	800	1,000

Soviet trade with other Western developed countries in 1980, in million rubles, was as follows: Canada, 1,000; Australia, 800; Switzerland, 800; Sweden, 700; Greece, 500; Spain, 400; and Denmark, 300.

Soviet trade with CMEA countries increased by 11% in 1980 compared with that of 1979. At the same time, the CMEA countries' share of Soviet foreign trade fell from 55.7% in 1978 and 51.9% in 1979 to 48.6% in 1980.

Soviet trade turnover with CMEA countries is shown, in million rubles, in the following tabulation:

Country	1975	1978	1979	1980
Bulgaria	3,991	6,142	6,486	7,099
Hungary	3,274	4,826	5,155	5,738
Vietnam	206	458	594	612
German Democratic Republic.	5,263	7,693	8,133	9,200
Cuba	2,589	4,169	4,249	4,266
Mongolia	480	743	772	884
Poland	4,853	7,050	7,555	8,002
Romania	1,526	1,950	2,146	2,791
Czechoslovakia	3,911	6,061	6,546	7,184

Trade with Yugoslavia increased by over 46% compared with the 1979 level, reaching 3,800 million rubles in 1980. Trade turnover with North Korea increased by 16%, reaching 572.1 million rubles. Trade with China decreased from 332 million rubles in 1979 to 317 million rubles in 1980. Shipments of Soviet goods to Laos increased by 48%, reaching 37 million rubles.

In 1980, the Soviet Union traded with 97 developing countries and commercial relations with 76 countries were regulated by intergovernment trade or economic treaties and agreement. In 1980, trade agreements were concluded with Gabon, Grenada, and Nicaragua.

Soviet trade turnover with developing countries is presented, in million rubles, in the following tabulation:

Country	1975	1978	1979	1980
India	686	771.4	1,035	1,740
Argentina	304	331.2	313	1,193
Iraq	600	1,084.0	1,182	732
Libya	19	158.6	437	451
Turkey	95	157.7	379	443
Syria	168	205.0	199	321
Afghanistan	132	215.0	324	505
Egypt	710	345.5	325	384
Iran	510	671.1	409	335
Brazil	396	165.1	180	275

In 1980, trade with Ethiopia reached 147 million rubles; with Angola, 95 million rubles; and with Yemen, 61 million rubles.

Soviet foreign trade continues to be oriented toward imports of needed machinery and equipment, including complete industrial plants. Fuels, mineral raw materials, and metals play the largest role in Soviet exports, representing about half of the total official exports during 1980. Soviet exports increased by 11.7% in 1980 over that of 1979, to a considerable extent as a result of the increased price of a number of goods on the world market. There was a particularly sharp rise in the price of energy sources.

During the 1976-80 period, the Soviet Union stepped up its exports of traditional raw materials such as oil and petroleum products, natural gas, coal and coke, precious and nonferrous metals, and some nonmetallic mineral commodities. In 1980, much of the mineral commodity exports were directed to CMEA nations, but there was also a large shipment to the West. Western Europe is a major importer of Soviet petroleum and natural gas. Sales of chromium, titanium, and platinum-group and precious metals have also been significant. Soviet gas is transmitted to the following CMEA countries: Poland, the GDR, Czechoslovakia, Hungary, Romania, and Bulgaria. Soviet gas is also flowing to Austria, the FRG, France, Italy, Finland, and Yugoslavia.

Estimated ferrous metal exports from the U.S.S.R. in 1980 were valued at over 2,000 million rubles, with rolled products accounting for 1,250 million rubles. In addition, in 1980, the Soviet Union exported an estimated 47 million tons of ferrous metal ores, including iron, manganese, and chrome ores, with a total estimate of 600 million rubles. High-quality ferrous metal imports were at 2,575 million rubles, including rolled steel products at 1,337 million and steel pipe at 1,238 million rubles. The U.S.S.R. became a net importer of ferrous products in 1978 and total steel imports are second only to grain in value. Despite being the world's largest steelmaker in tonnage, the Soviet Union needs to import considerable amounts of high-quality products from abroad to cover domestic demand, especially pipe and some rolled products.

The planned amount of foreign exchange was easily achieved in 1980 by a smaller level of gold and other mineral industry commodity sales because of the higher prices for these commodities. The U.S.S.R. traditionally sells most of its gold through Zurich, Switzerland, but a small share of Soviet gold is sold at other European and American gold markets. In recent years very little, if any, gold from the U.S.S.R. has been sent directly to London. In 1979, reportedly, the U.S.S.R. sold 230 tons and in 1978, 400 tons of gold. Soviet gold sales in 1980 dropped back sharply from the 1979 level. The U.S.S.R. transferred 39.76 tons of gold to the Swiss bullion market, and also sold some metal through London and New York. It is estimated that the U.S.S.R. sold only 80 tons of gold in 1980. The sale of gold in previous years were so high that stocks were depleted and what was sold in 1979, in fact, conformed more closely to current production. The Soviet Union normally sells its gold when prices are high and keeps the returns for an emergency. The U.S.S.R. may have ceased selling gold for a period, since its earnings from oil and gold in 1979 have given it enough foreign currency for its planned requirements.

The program for the sale of Soviet platinum, gold, and silver Olympic coins was completed in early 1980, and according to Y. Kuzkin, Deputy Chairman of the Board of the Soviet Bank, $170 million worth of coins have been sold in 20 Western countries. The FRG, the United States, Switzerland, Canada, and Belgium were the main customers.

The Soviet Union is a net exporter of lead and zinc. Lead exports from the U.S.S.R. averaged about 100,000 tons per year in the 1970-80 period, while imports (metal and concentrate) for the same period averaged over 80,000 tons. Zinc exports from the U.S.S.R. averaged over 100,000 tons per year from 1965 through 1980, while imports (metal and concentrate) amounted to over 70,000 tons per year in the 1970's. Unexpected heavy buying of lead and zinc by CMEA countries, headed by the U.S.S.R. in 1979, was caused by considerable decreases in shipments of Iranian lead and zinc ore and concentrate. Soviet imports of Iranian lead

ore and concentrate decreased from 47,695 tons in 1978 to 17,117 tons in 1979, and that of zinc ore and concentrates decreased from 72,241 to 5,914 tons for the same years.

The U.S.S.R. used to be a major exporter of mercury. In 1979-80, it sold an estimated 8,000 to 9,000 flasks to Western free markets. However, it is not expected that mercury will be exported to the West in 1981. The Soviet Union has considerably halted aluminum shipments to the West. As a result of problems in mining of potash in the Urals' mines, Soviet exports of potassium decreased from 5.77 million tons in 1978 to 4.77 million tons in 1979 and to an estimated 5 million tons (Soviet standard) in 1980. It is possible that exports of palladium, titanium, and high-grade chromium to the West may also be decreased in the future.

In 1980, the Soviet Union imported machines and equipment in total value of 15,100 million rubles. Machines and equipment is the largest group of the U.S.S.R.'s imports. Their share in the total Soviet imports amounted to 34%. In 1980, goods worth 15.7 billion rubles were imported from Western developed countries, including machinery, equipment, and transport facilities worth 4.7 billion rubles, rolled steel products worth 1,337 billion rubles, and steel pipe worth 1,238 billion rubles. Between 1976 and 1979 Soviet imports of Western equipment for the chemical industry increased almost threefold over the previous 5 years to reach 6.2 billion rubles. This equipment has been put into operation at ammonia, carbamide, and superphosphate producing plants in the cities of Odessa, Togliatti, Gorlovka, Novgorod, Cherepovets, Dneprodzerzhinsk, and others.

The Soviet Union imports large quantities of bauxite, alumina, rolled steel and pipe, tin, fluorine, barium, and some copper, lead, zinc, cadmium, tungsten, silver, antimony, molybdenum, and mica. In 1978 and 1979, the U.S.S.R. imported about 16 tons of silver each year. In 1980, it purchased over 31 tons. The country increased imports of tungsten and some other commodities in 1980.

Large-scale and long-term cooperation increasingly accounts for the growth in Soviet trade with Western countries, which doubled during the 1976-80 period, showing a rise of 15.5 billion rubles. The U.S.S.R.'s main exports to Western Europe are crude oil, petroleum products, and natural gas. Western Europe has been an importer of Soviet natural gas since 1968 when a branch of the Brotherhood Trunkline, which feeds Eastern Europe, reached Austria. Export contracts have since been signed with the FRG, France, Italy, and Finland guaranteeing shipments of natural gas over a 20-year period. Natural gas exports will soon become the Soviet Union's second main trade commodity (after petroleum). More than half of the hard currency earnings come from oil and gas sales. Shipments to France were scheduled to begin in February 1980 under a 4-billion-cubic-meter annual delivery contract. Soviet deliveries of natural gas to Western Europe were to be increased by 20% in 1980 compared with that of 1979 shipments.

West European banks are negotiating with the U.S.S.R. credits of $10 billion to finance the purchase of steel pipe and pumping equipment for the construction of a 5,000-kilometer gas pipeline to transport gas from Siberia to Western Europe. Under the new proposed gas for steel pipe and pipeline equipment deal, the FRG, France, Italy, Belgium, Austria, the Netherlands, and Luxembourg would receive up to 40 billion cubic meters of Soviet gas annually over 20 years starting in 1985. The FRG is to receive between 10 and 12 billion cubic meters annually. The cost of the entire project has been estimated at $14 billion. Soviet petroleum exports of OEDC countries, chiefly in Western Europe, declined slightly for the first time in 1979.

Trade between the U.S.S.R. and the FRG in 1976-80 more than doubled over the years 1971-75, and in 1980, for the eighth year, the FRG was the Soviet Union's biggest trading partner among the Western countries. The U.S.S.R. supplies the FRG with natural gas, crude oil, and a number of important raw materials. Reportedly, Soviet deliveries of enriched uranium supplied more than one-half of the FRG's requirements. Soviet palladium, titanium, and asbestos accounted for a large share of the FRG's consumption. During the 20 years following the conclusion of the first contract, the Mannesmann Corp. of the FRG has supplied 6 million tons of large-diameter steel pipes to the U.S.S.R. From 450,000 to 715,000 tons of large-diameter pipes were annually supplied to the Soviet Union. In addition, pipes of other types for the oil industry, in particular, had also been delivered to the U.S.S.R. No less than 13% of all West German steel pipe export is absorbed by the U.S.S.R. About 15% of all exported steel plate and over

10% of all machine tools sold abroad are shipped to the U.S.S.R. At the same time, West German imports from the U.S.S.R. advanced at a rate of 50% less than overall West German purchases abroad.

Soviet-Finnish trade turnover in the 1975-80 period exceeded 12 billion rubles compared with the initially planned amount of 9 billion rubles. In 1981, mutual trade is to reach a total value of FM24.4 billion, compared with an estimated 22 billion in 1980. Soviet export of crude oil, which was expected to amount to 7 million tons in 1980, is to increase slightly in 1981. The 1981-85 Soviet-Finnish trade agreement calls for trade valued at more than $23.5 billion. Nearly half of the Finnish exports are metal industry products, mainly ships and ship equipment, machinery, cables, steel products, and others. In return, the U.S.S.R. supplies Finland with crude oil, petroleum products, natural gas, nuclear fuel, coal, coke, and electricity.

The Soviet-French trade increased 23% over the 1979 level and reached 4 billion rubles (F F 10.4 billion) in 1980. In 1980, the U.S.S.R. had to supply France with over 8 million tons of crude and petroleum products and 4 billion cubic meters of natural gas. France is one of the Soviet Union's most preferred Western trading partners. On July 21, 1980, the Finsider Co. of Italy signed a $2.5 billion 5-year exchange agreement in the U.S.S.R. Under the agreement, the Soviet Union will supply Italy coal, nickel, iron ore, and steel scrap in exchange for 500,000 tons per year of large-diameter pipe, steel plates, electrical sheets, and other steel products. Italy has announced that the state holding company, Ente Nazionale Idrocarburi would participate in a $10 billion project to transport Siberian natural gas to Western Europe.

Japanese steelmakers have agreed to supply a huge Soviet order for 1 million tons of large-diameter steel pipe and 360,000 tons of steel plate to be delivered each year for the next 5 years. But the realization of the agreement will depend on whether or not the Export-Import Bank of Japan will approve Government financing for pipe export. Reportedly, Japan's Government has been asked by the U.S.S.R. to provide between $2 billion and $3 billion in loans for promotion of a Siberia-Western Europe gas pipeline project. The U.S.S.R. was interested in importing up to 60,000 tons of Japanese alumina in both 1980 and 1981. About 1,500 tons of copper ingots will be sent by Japanese copper smelters to the Soviet Union in 1981. Soviet aluminum scrap exports to Japan picked up in 1980, but coking coal shipments that same year to Japan were short 840,000 tons. Under the 1974 agreement, the U.S.S.R. was committed to begin shipping between 3.2 million and 5.5 million tons of coking coal from the Neryunga complex, South Yakutia, on an annual basis between 1983 and 1998. However, the Soviet Union notified Japanese coal importers that it cannot start shipments of Neryungian coal in 1983.

Reportedly, in 1980, British exports to the Soviet Union rose by 8% to £452.8 million while British imports fell by 5% to £786.2 million. The Soviet Union exports 40,000 to 60,000 tons per year of aluminum scrap (aluminum content) and also exports zinc slag, titanium solids and turnings, some tin, and occasionally some copper in the form of old radiators. The United Kingdom and the United States take considerable quantities of titanium scrap, while Japan, Austria, and Italy import a lot of aluminum scrap.

The Soviet Union's trade turnover with the United States decreased to $1.5 billion in 1980. The value of U.S. exports to the Soviet Union fell 58% in 1980. American exports to the U.S.S.R. had a value of $1,510 million in 1980 compared with a value of $3,604 million in 1979. The fall was due almost entirely to the decline in U.S. agriculture exports. The U.S. Trade Commission, in October 1979, determined that imports of Soviet ammonia were disrupting domestic markets and recommended a quota of 1 million tons in 1980, 1.1 million tons in 1981, and 1.3 million tons in 1982. In November 1979, the President embargoed the sale of 17 million tons of grain and exports of all phosphate fertilizers to the U.S.S.R. In addition, the President reimposed an emergency quota on Soviet ammonia imports of 1 million tons in 1980.

During the years 1979-80 the U.S.S.R. exported to the United States the following mineral industry commodities, in million U.S. dollars:

Commodity	1979	1980
Anhydrous ammonia	56.5	94.8
Gold bullion, refined	548.3	85.7
Palladium	62.1	54.6
Uranium compounds, fluorides	--	34.6
Nickel, unwrought	28.6	20.7
Metal coins, n.e.s	25.2	18.3
Palladium bars, plates, etc	2.3	11.7
Uranium compounds, n.e.s	--	9.0
Platinum bars, plates, etc	3.5	7.0
Rhodium	9.9	6.3
Crude petroleum, testing under 25° A.P.I. (heavy fuel oils)	6.8	6.3
Platinum-group metals and combinations, n.e.s.	16.0	5.2
Naphthas, derived from petroleum, etc., n.e.s.	--	5.0
Titanium waste and scrap, unwrought	8.0	4.6
Platinum sponge	5.2	4.6
Chrome ore, chromium content not over 40% chromic oxide.	10.7	3.8
Diamonds, over 1/2 carat, cut, not set	1.9	3.0
Titanium sponge, unwrought	2.6	2.7

Sales of Soviet titanium in the United States in 1979 totaled about 300 tons of sponge and over 280 tons of ingot. In 1980, there were sales of only about 100 tons of Soviet sponge. The Soviet Union offered limited quantities of titanium sponge to the U.S. market in 1981 at approximately $10 per pound, down from $25 per pound in 1980. In the first 4 months of 1980, Soviet exports of chromite grading more than 46% Cr_2O_3 to the U.S. were 31,000 tons.

Reportedly, a consortium of Dutch banks has agreed to provide up to $1.2 billion worth of financing to Dutch companies involved in the construction of a 5,000-kilometer gas pipeline from West Siberia to Western Europe. Trade between the U.S.S.R. and the Belgium-Luxembourg Union has increased almost fivefold in the past 10 years. Reportedly, Belgium, aiming to secure gas supplies from the Soviet Union, announced in October 1980 that a credit of about $1,000 million is being negotiated with the Soviet Union by a consortium of Belgian banks to help finance a natural gas pipeline from Siberia to Western Europe. Use á Tubes de la Meuse, a Belgian steelmaker, received a contract worth $480 million to supply the U.S.S.R. with 500,000 tons of seamless pipes over 5 years. The deal forms part of a project to build a gas pipeline from Siberia to Western Europe.

Soviet-Austrian trade in 1980 amounted to 1,000 million rubles, the highest annual figures for bilateral trade in the post-war period. The Soviet Union shipped oil, coal, and other mineral products to Austria. The Soviet Union wants to double trade with Sweden by 1990, especially trade in metal and energy products, including Soviet imports of drilling equipment for oil and gas on continental shelves and offshore. The U.S.S.R. has offered to supply Sweden with natural gas. The supply of gas to Sweden from the Soviet Union would be made possible by the construction of a pipeline across Finland. The quantity is to be a minimum of 1.5 to 2 billion cubic meters of gas per year. Finland has been importing just under 1,000 million cubic meters of gas annually from the U.S.S.R. since 1974.

During the 1978-80 period, the U.S.S.R. imported over 80,000 tons per year of copper concentrate (over 20,000 tons of metal content) from Canada. The Soviet Union has signed an agreement with Spain on exports to Spain of 150,000 tons of ammonia until 1983. Soviet-Swiss trade in 1980 amounted to 800 million rubles. The Swiss authorities are now considering the question of buying natural gas from the U.S.S.R. Soviet-Greek trade in 1980 reached a value of 400 million rubles, nearly double the figure for 1979.

The U.S.S.R. provides nearly 100% of the CMEA countries' imports of crude oil, natural gas, pig iron, and electric power; about two-thirds of their petroleum products, rolled ferrous metals, and phosphorous fertilizers; about 60% of their coal and manganese ore; and up to 90% of their iron ore. Of the six East European members of CMEA, only Romania and Hungary do more business with the West than with the U.S.S.R. In the 1976-80 period, the Soviet Union was to supply its CMEA partners with 370 million tons of crude, 46 million tons of petroleum products, 88 billion cubic meters of natural gas, and 64 million megawatt-hours of electricity. During the 1981-85 period, Soviet energy deliveries to CMEA nations are to be increased by 20% over that of 1976-80, but almost none of it will be in oil. The expected Soviet oil exports to CMEA countries in 1981-85 will be 400 million tons, or the 1980 level of 80 million tons per year. Substantial quantities of iron ore, rolled ferrous metals, nonferrous metals, and chemical products are to be supplied.

According to the CMEA Secretariat, in the last 5 years exports of Soviet natural gas to East European countries increased by 200%, from 13.4 billion cubic meters in 1976 to about 27 billion cubic meters in 1980, and that of oil and electricity increased by 50%. The 1980 planned deliveries of Soviet petroleum to East European CMEA countries were: Bulgaria, 13 million tons of crude oil;

Czechoslovakia, 19.2 million tons of crude and products; the GDR, 19 million tons of crude and products; Hungary, 7.5 million tons of crude oil; Poland, 15.9 million tons of crude (13.1 million) and products (2.8 million); Romania, 1.0 million tons of crude and products.

In 1980, Soviet exports of iron ore, pig iron, copper, zinc, and aluminum to CMEA nations increased over that of 1979. The Soviet Union's exports permit a controlling influence over the economies of its CMEA satellites. In Eastern Europe, this control rests largely on the fuels and energy trade. Romania is the only country producing moderate quantities of oil; all others are heavily dependent upon liquid fuel imports. The U.S.S.R. has a controlling influence over the metallurgical industries of the CMEA nations through exports of coke and ferrous and nonferrous metals.

In 1981-85, Soviet-Bulgarian trade is to exceed 40 billion rubles, an increase of 37% over the 1976-80 level. In 1980, Bulgaria was to receive 4 billion cubic meters of gas from the U.S.S.R. Soviet-Czechoslovakian trade in 1976-80 totaled 29 billion rubles, and an increase of 35% is anticipated in the 1981-85 5-year period. In 1980, the U.S.S.R. was to deliver to Czechoslovakia 19.2 million tons of crude and petroleum products at a cost of 1,125 million rubles, and 8.7 billion cubic meters of natural gas. During the 1981-85 period, Czechoslovakia anticipates annual purchases from the U.S.S.R. of 18 million tons of crude oil, 8 million tons of iron ore in terms of iron content as well as 1 million tons of pig iron, several billion cubic meters of natural gas, and various other deliveries. Soviet-Czechoslovakian trade in 1981 is to amount to 7.7 billion rubles. The U.S.S.R. is to supply 19 million tons of crude oil, nearly 9 billion cubic meters of natural gas, iron ore, and nonferrous metals for the same year. Czechoslovakia is to supply the U.S.S.R. in 1981 with 300,000 tons of steel pipe worth 120 million rubles. The pipes are to be mainly of the seamless variety for use in oil and gas pipelines and in the oil-refining industry.

Reportedly, in 1980 the GDR imported the following mineral commodities from the U.S.S.R.: 19 million tons of crude oil and products, 6.5 billion cubic meters of natural gas, 1.7 million tons of iron ore (iron content), 3.2 million tons of rolled steel, 130,000 tons of aluminum, 42,000 tons of copper, 430,000 tons of apatite concentrate, and other mineral commodities. Soviet-East German trade in 1981 is to reach 10 billion rubles, an increase of about 10% over the 1980 level. During the 1981-85 5-year plan period the GDR is scheduled to import from the Soviet Union 95 million tons of crude oil and petroleum products, 32.5 billion cubic meters of natural gas, 8.5 million tons of iron ore (iron content), 4.5 million tons of pig iron, 650,000 tons of aluminum, 211,500 tons of copper, 6.5 million tons of coke, 21 million tons of hard coal, and other mineral commodities. Although these trade figures are impressive, in reality Soviet deliveries of mineral industry commodities will remain at their 1980 level during the 1981-85 period. The GDR will supply the U.S.S.R. mostly with machinery and equipment.

In 1980, Hungary obtained 76% of its oil requirements (7.5 million tons), 27% of its natural gas, 23% of electric power, and more than half its aluminum (in exchange for alumina) from the U.S.S.R. In 1981, Soviet-Hungarian trade is to reach 6 billion rubles. The U.S.S.R. will continue to supply Hungary with oil, natural gas, iron ore, electricity, etc. In 1981-85, total Soviet-Hungarian trade is to amount to 34 billion rubles. Soviet imports of Mongolian fluorspar increased in 1980. During the 1976-80 period, trade between the U.S.S.R. and Romania grew by 70% in comparison with the 1971-75 period and amounted to 9 billion rubles. The Soviet Union delivered 0.4 million tons of crude oil to Romania in 1979 and agreed to ship about 1 million tons of crude to Romania in 1980.

The U.S.S.R. exports to Poland include iron, manganese and chrome ore, asbestos, apatite concentrate, pig iron, ferroalloys, lead, aluminum, and other products. Poland ships to the Soviet Union sulfur, zinc, copper, cadmium, coal, and other products. In 1980, Poland was to receive from the Soviet Union 13.1 million tons of crude oil, 2.8 million tons of petroleum products, over 5 billion cubic meters of natural gas, about 9 million tons of iron ore, etc. The Soviet Union and Poland signed a long-term agreement that runs to 1990. The U.S.S.R. has agreed to maintain raw material sales to Poland at the 1980 level. Cuba supplies the Soviet Union with nickel-cobalt concentrate. Soviet-Cuban trade is to amount to approximately 30 billion rubles in the 1981-85 period, or about 50% more than in 1976-80. The U.S.S.R. has promised to deliver 61 million tons of oil to Cuba during the 1981-85 period.

The Soviet Union now holds first place

among Yugoslavia's trading partners. In 1981-85, Soviet-Yugoslavia trade is to exceed $26 billion. The U.S.S.R. will continue to supply Yugoslavia with oil and natural gas. Alumina and nonferrous metals will be among the products supplied by Yugoslavia. U.S.S.R.-mainland China trade dropped by about 5% in 1980 from the 1979 level. The U.S.S.R. exports to North Korea coal, coke, crude oil, petroleum products, ferroalloys, chrome and manganese ores, asbestos, sulfur and rolled steel. Soviet mineral imports from North Korea consist of zinc, lead, cadmium, ingot, and rolled zinc.

An important new element in trade treaty relations with developing countries is the conclusion of long-term agreements and programs on economic, scientific, and technical cooperation over a period of 10 to 15 years covering a wide field of commercial relations and creating opportunities for cooperation in the utilization of mineral resources. Soviet exports to developing countries consist mainly of machinery and equipment. From a total of $5.1 billion in imports in 1980, over 20% were mineral industry related commodities.

According to preliminary figures, Soviet trade with African countries in 1980 amounted to $2 billion, an increase of 20% over that of 1979. In the first three quarters of 1980, trade with Guinea increased by almost 20%, with the Congo by 50%, and with Benin by 100%. Soviet trade with Angola, Libya, and Algeria also grew noticeably. Soviet imports of Guinean bauxite will be increased from an estimated 2.3 million tons in 1980 to 3 million tons in the future.

In 1980, India replaced Iraq as the biggest trade partner with the Soviet Union among the developing countries. India received an additional 700,000 tons of Soviet oil and products in 1980, in exchange for rice, above the 1.5 million tons supplied under a long-term agreement. India's request for 5 million to 6 million tons of Soviet oil annually in exchange for 1.5 million tons of grain (oil for grain deal) is to be negotiated. Soviet imports of Indian mica amounted to an estimated 850 tons in 1980 compared with 680 tons in 1979. The U.S.S.R. has supplied about 35,000 tons per year of sulfur to India since 1971, but shipped only 25,000 tons in 1979. The U.S.S.R. is reported to have agreed to take 3 million tons of iron ore from India's Kudremukh project.

Reportedly, Argentina intends to buy enriched uranium from the Soviet Union for medical purposes. Argentina is also buying heavy water from the U.S.S.R. The U.S.S.R. supplied Turkey with oil, fertilizers, ammonia, ferroalloys, ferrous rolled metal, and electricity. Shipments of Afghan gas to the U.S.S.R. totaled 2.5 billion cubic meters in 1980, a 16% increase over that of 1979. Fertilizers and rolled ferrous metals will be provided by the Soviet Union to Afghanistan during the 1981-83 period under an agreement signed in August 1980. Before the revolution in Iran, the U.S.S.R. imported about 10 billion cubic meters of Iranian associated gas. Deliveries dropped to about 2.5 billion cubic meters in 1979. Because of price disagreement, Iran cutoff deliveries of gas in March 1980 and negotiations for resulting gas sales continued in 1980. Exports of Iranian lead and zinc ores and concentrates has decreased considerably during the 1979-80 period.

Reportedly, Brazil has accepted the Soviet order to export petroleum to Brazil. The U.S.S.R. is interested in buying some of the Brazilian columbium production. The U.S.S.R. supplied Morocco with oil, petroleum products, ammonia, and imported superphosphate. An agreement between the Soviet Union and Morocco on trade in 1981-85 was signed in November 1980. The Soviet Union will import from Morocco superphosphate and phosphoric acid. Agreement was also reached on Soviet assistance in prospecting for phosphates in Morocco.

Reportedly, the U.S.S.R., a previous exporter of graphite, has attempted to buy large quantities of graphite from Madagascar. Mozambique shipped tantalite to the U.S.S.R. in 1980. According to an agreement, Kenya shipped to the Soviet Union fluorspar worth £2.09 million. Under another agreement, the U.S.S.R. will purchase 50,000 tons of fluorite from Thailand in 1981.

Recently, there have been changes in Soviet mineral trade patterns. According to some Western experts, the U.S.S.R. has ended most mineral export sales to the West. Moreover, the Soviets have actively been purchasing metals in which that country has been self-sufficient, and the U.S.S.R. has switched from a net exporter to net importer of these commodities. These experts explain that a new pattern in Soviet minerals trading is the beginning of a fundamental shift in mineral trade policy to the "Resource War."

According to these experts, Soviet mines suffer from depletion of reserves and poor recovery rates. The high financial and tech-

nological cost of extracting minerals and the shortage of raw materials on the world market have produced the "shift" in Soviet mineral policy. The liabilities these analysts have in mind concern the potential risk of conflict with the United States over access to strategic raw materials.

After careful examination of all the available facts on Soviet mineral production and trade it was found that:

1. In the Soviet minerals economy, international trade is given high priority. Since the value and volume of trade are both outlined in the national plans, foreign trade reflects national goals and priorities. There is, therefore, an implied commitment to export to achieve a desired trade balance and this can result in sales below world prices. Domestic consumer demand is a less important motivation than exports. Soviet exports are not surplus and almost all exports could easily be consumed domestically.

2. Exports of some mineral commodities have declined and imports of some nonfuel materials have begun, but the U.S.S.R. has not switched from a net exporter to net importer except for tin and in value of rolled steel products.

3. The Soviet Union is a substantial supplier of many mineral commodities to the West. Price increases in petroleum, gold, platinum-group metals, diamonds, and other Soviet-exported mineral commodities led the U.S.S.R. to decrease its sale of some minerals to the West in the 1977-80 period. The increased precious metals and diamond sales and increased return on petroleum sales have allowed that country to keep other critical metal supplies for domestic use. The Soviets export many mineral commodities which they need more than the country to which they are exported. Among those metals now being safeguarded from excessive export are high-quality chromium, manganese, asbestos, titanium, vanadium, and nickel.

During the August-October 1980 period, the Soviet Union reportedly sold more than 1.8 tons of platinum-group metals valued at about 32.6 million Swiss francs. Due to slackening prices, gold sales dropped to 80 tons for the year, from more than 400 tons in 1978, and over 200 tons in 1979.

4. Increases in imports of lead and zinc ingots during the 1978-80 period has resulted from a substantial decrease of Soviet imports of Iranian lead and zinc ore and concentrates. These metals were sent to the GDR and Czechoslovakia on Soviet account.

5. Soviet mineral commodities exports to the West peaked in 1978. In the future, the U.S.S.R. will benefit from the continued increase in world oil and other mineral commodity prices. In regard to exports, a striking change is the considerable increase in the U.S.S.R.'s return from its exports of crude oil and petroleum products. The share of these commodities of the Soviet's Western exports increased by about 7% in 1978. In this respect, the U.S.S.R. profited by the price policy pursued by the Organization of Petroleum Exporting Countries. It reduced the shipments of petroleum to the OECD countries from 60.4 million tons in 1978 to 58.8 million tons in 1979, or by 1.6 million tons.

6. Due to unresolved questions on natural gas price, financing, and equipment supply, the signing of the U.S.S.R.-West German large gas pipeline deal has been postponed until the summer of 1982.

Table 9.—U.S.S.R.: Estimated production, trade, and consumption of mineral commodities in the U.S.S.R., 1980

(Thousand metric tons unless otherwise specified)

Commodity	Production	Imports	Exports	Apparent consumption
METALS				
Aluminum:				
Bauxite	4,600	3,500	--	8,100
Nepheline concentrate	2,500	--	--	2,500
Alunite	600	--	--	600
Alumina	2,700	1,000	--	3,700
Metal:				
Primary	1,790	9	560	1,239
Secondary	150	--	70	80
Antimony ---tons	8,200	900	--	9,100
Arsenic, white (As_2O_3) ---do	7,700	--	35	7,665
Beryllium 10% to 20% BeO ---do	1,800	Ins.	--	1,800
Bismuth ---do	72	5	--	77
Cadmium ---do	2,850	150	45	2,955
Chromium, 30% to 56% Cr_2O_3	2,450	--	750	1,700

See footnotes at end of table.

Table 9.—U.S.S.R.: Estimated production, trade, and consumption of mineral commodities in the U.S.S.R., 1980 —Continued

(Thousand metric tons unless otherwise specified)

Commodity	Production	Imports	Exports	Apparent consumption
METALS —Continued				
Cobalt ---------- tons	2,050	1,600	--	3,650
Copper:				
Primary ----------	905	65	240	730
Secondary ----------	95	--	16	79
Gold ---------- thousand troy ounces	8,300	--	2,500	5,800
Iron and steel:				
Iron ore ----------	[1]245,000	--	40,000	205,000
Sinter ----------	159,000	--	--	159,000
Pellets ----------	45,000	--	--	45,000
Pig iron and ferroalloys ----------	[1]109,500	Ins.	4,600	104,900
Steel, crude ----------	[1]148,000	Ins.	800	147,200
Steel, rolled ----------	[1]103,000	7,000	6,600	103,400
Scrap ----------	51,000	--	2,000	49,000
Lead:				
Primary ----------	525	80	100	505
Secondary ----------	100	--	--	100
Magnesium metal ----------	74	--	3	71
Manganese ore ----------	10,250	--	1,350	8,900
Mercury ---------- 76-pound flasks	62,000	--	Ins.	62,000
Molybdenum ---------- tons	10,400	Ins.	Ins.	10,400
Nickel ----------	154	20	23	151
Platinum group metals thousand troy ounces	3,250	Ins.	1,900	1,350
Silver ---------- do	46,000	1,000	--	47,000
Tin:				
Primary ---------- tons	36,000	5,800	--	41,800
Secondary ---------- do	12,000	--	--	12,000
Titanium ---------- tons	37,000	--	3,600	33,400
Tungsten ---------- do	8,700	100	Ins.	8,800
Zinc:				
Primary ----------	785	70	100	755
Secondary ----------	80	--	--	80
NONMETALS				
Abestos ----------	2,150	Ins.	500	1,650
Barite ----------	500	500	--	1,000
Boron, B_2O_3 content ----------	100	--	10	90
Cement ----------	[1]125,000	600	3,500	122,100
Clays ----------	2,500	Ins.	200	2,300
Corundum, natural ---------- tons	8,600	2,000	--	10,600
Diamond:				
Gem ---------- thousand carats	2,250	Ins.	1,200	1,050
Industrial ---------- do	8,600	Ins.	700	7,900
Diatomite ----------	225	Ins.	--	225
Feldspar ----------	310	--	--	310
Fertilizer materials:				
Nitrogen: N content ----------	9,300	--	2,500	6,800
Phosphatic:				
Apatite:				
Ore, 16% P_2O_5 ----------	45,000	--	Ins.	45,000
Concentrate, 39.4% P_2O_5 ----------	16,500	--	6,000	10,500
Sedimentary rock:				
Ore, 13% P_2O_5 ----------	19,000	--	--	19,000
Concentrate, 19% to 25% P_2O_5 ----------	9,500	--	600	8,900
Potash, K_2O equivalent ----------	8,000	--	2,300	5,700
Fluorspar ----------	520	550	--	1,170
Graphite ----------	100	Ins.	--	100
Gypsum and plasters ----------	5,400	Ins.	150	5,250
Lime, dead-burned ----------	24,500	Ins.	Ins.	24,500
Magnesite, crude ----------	4,000	480	18	3,538
Mica ----------	46	1	--	47
Pyrite: Sulfur content ----------	3,550	--	300	3,250
Salt, all types ----------	14,500	Ins.	400	14,100
Sulfur, elemental (excluding sulfur content of pyrite) ----------	7,350	600	130	7,820
Sulfuric acid ----------	23,000	75	165	22,910
Talc ----------	490	26	Ins.	516
MINERAL FUELS				
Coal:				
Anthracite ----------	79,000	--	4,000	75,000
Bituminous: Coking ----------	185,000	10,000	23,000	172,000
Other ----------	288,000	--	--	288,000
Lignite and brown coal ----------	164,000	15,000	--	179,000
Gas, natural ------ million cubic meters	[1]435,000	4,000	35,000	404,000
Peat:				
Agricultural ----------	131,600	--	--	131,600
Fuel use ----------	60,000	--	--	60,000

See footnotes at end of table.

Table 9.—U.S.S.R.: Estimated production, trade, and consumption of mineral commodities in the U.S.S.R., 1980 —Continued

(Thousand metric tons unless otherwise specified)

Commodity	Production	Imports	Exports	Apparent consumption
MINERAL FUELS —Continued				
Oil shale	35,000	--	--	35,000
Petroleum:				
Crude	[1]603,000	5,000	120,000	488,000
Refinery products	415,000	1,000	40,000	376,000

Ins. - Insignificant.
[1]Reported in Soviet sources.

Table 10.—U.S.S.R.: Net import reliance of selected minerals and metals as a percent of consumption in 1980

Commodity	Net import reliance (minus numbers show exports)	Principal sources
METALS		
Aluminum	-43	
Antimony	10	Yugoslavia.
Bauxite and alumina	60	Guinea, Yugoslavia, Hungary, India.
Cadmium	5	
Chromium	-44	
Cobalt	43	Cuba.
Columbium	--	
Copper	-25	
Gold	-43	
Iron ore	-20	
Iron and steel scrap	-4	
Lead	-3	
Manganese	-15	
Mercury	--	
Molybdenum	--	
Nickel	-2	
Platinum-group metals	-140	
Selenium	--	
Silver	2	
Steel mill products	1	West Germany, Japan, Italy, France.
Strontium	--	
Tantalum	--	
Tellurium	--	
Tin	11	Malaysia, United Kingdom, Bolivia.
Titanium (ilmenite)	-11	
Titanium (rutile)	--	
Tungsten	2	China, mainland, Mongolia.
Vanadium	-5	
Zinc	-4	
NONMETALS		
Asbestos	-30	
Barium	50	Yugoslavia, North Korea, Bulgaria.
Cement	-3	
Gypsum	--	
Fluorine	47	Mongolia, China, mainland, Thailand.
Mica sheet	2	India.
Potassium	-40	
Pumice	--	
Salt	-3	
Sulfur	--	
MINERAL FUELS		
Natural gas	-8	
Petroleum	-33	

Table 11.—U.S.S.R.: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Oxides and hydroxides	--	34	Singapore 30.
Metal including alloys:			
Scrap	67,443	31,163	Austria 22,167; United States 8,968.
Unwrought	434,972	382,147	Hungary 158,543; Japan 74,081; Czechoslovakia 65,000.
Semimanufactures	17,537	13,323	Poland 7,759; Hungary 3,140; Yugoslavia 1,652.
Arsenic:			
Trioxide, pentoxide, acids	--	76	All to Greece.
Metal including alloys, all forms	35	87	Yugoslavia 75; West Germany 12.
Beryllium metal including alloys, all forms	--	1	All to France.
Chromium:			
Chromite[3] thousand tons	738	775	United States 234; Poland 134; Czechoslovakia 128; Yugoslavia 80.
Oxides and hydroxides[3]	5,405	5,780	Czechoslovakia 520; Japan 500; Australia 357; Bulgaria 350.
Metal including alloys, all forms	767	340	All to Belgium-Luxembourg.
Cobalt oxides and hydroxides kilograms	65	50	All to Yugoslavia.
Copper:			
Matte	[4]300	--	
Sulfate[3]	21,194	20,862	Bulgaria 8,300; Hungary 3,700; Switzerland 1,878.
Metal including alloys:			
Scrap	729	1,962	Australia 1,546; West Germany 345.
Unwrought	58,332	48,250	Czechoslovakia 39,000; Finland 5,004;[4] West Germany 2,539.
Semimanufactures	1,728	1,466	Yugoslavia 1,193; Poland 172.
Germanium metal including alloys, all forms kilograms	300	--	
Iron and steel:			
Ore and concentrate including pellets[3] thousand tons	r46,071	44,504	Poland 13,412; Czechoslovakia 9,876; Romania 7,053.
Pyrite roasted do	86	48	All to Hungary.
Metal:			
Scrap[3] do	1,677	1,987	Italy 539; East Germany 394; Yugoslavia 225; Japan 153.
Pig iron do	3,228	2,702	Poland 1,247; Czechoslovakia 729; Bulgaria 356; Hungary 222.
Ferroalloys do	132	100	Hungary 43; Poland 20.
Steel, primary forms do	758	787	Hungary 363; Yugoslavia 168; West Germany 76; Turkey 75.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	1,596	1,517	Poland 638; East Germany 616; Hungary 145; Bulgaria 79.
Universals, plates, sheets do	951	905	East Germany 464; Hungary 217; Bulgaria 132; Poland 65.
Hoop and strip do	10	16	Yugoslavia 10; Bulgaria 5.
Rails and accessories do	1	2	Yugoslavia 1.
Wire do	6	8	Hungary 6.
Tubes, pipes, fittings do	r59	46	Yugoslavia 17; Poland 5; West Germany 3.
Castings and forgings, rough do	6	2	Poland 1.
Lead metal including alloys:			
Scrap	--	513	All to United Kingdom.
Unwrought	32,303	37,012	Czechoslovakia 25,000; Finland 7,710;[4] Poland 4,006.
Semimanufactures	63	27	All to Saudi Arabia.
Magnesium metal including alloys, unwrought	2,779	1,077	Yugoslavia 433; Japan 297; West Germany 227.
Manganese:			
Ore and concentrate[3] thousand tons	1,186	1,317	Poland 518; Czechoslovakia 423; East Germany 182; Bulgaria 103.
Oxides	10	--	
Metal including alloys, all forms	--	259	All to Sweden.
Mercury 76-pound flasks	(5)	406	France 203; West Germany 116.
Molybdenum:			
Ore and concentrate	--	11	All to West Germany.
Metal including alloys, all forms	(5)	13	West Germany 9; Yugoslavia 4.
Nickel:			
Ore and concentrate	--	25	All to West Germany.
Matte and speiss	1,754	811	Sweden 684; France 100.
Metal including alloys:			
Scrap	--	62	Austria 61.
Unwrought	r22,089	28,871	West Germany 8,330; United States 5,310; Czechoslovakia 4,746.

See footnotes at end of table.

Table 11.—U.S.S.R.: Apparent exports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS —Continued			
Nickel —Continued			
Metal including alloys —Continued			
Semimanufactures	r398	118	Yugoslavia 111.
Platinum and platinum-group metals including alloys, unworked or partly worked value, thousands	$224,577	$205,399	United States $100,877; West Germany $46,158; Japan $17,363.
Silver:			
Ore and concentrate do	$14	--	
Waste and sweepings do	$200	$919	All to Switzerland.
Metal including alloys, unworked or partly worked do	$32	$4,634	United States $4,005; Italy $628.
Tin metal including alloys:			
Unwrought	--	5	All to West Germany.
Semimanufactures kilograms	27	50	All to Yugoslavia.
Titanium:			
Ore and concentrate	55	485	All to Italy.
Oxides	--	22	All to Spain.
Metal including alloys, all forms	3,583	4,678	United States 3,426; West Germany 608; Sweden 465.
Tungsten ore and concentrate	21,438	25	All to United Kingdom.
Zinc:			
Ore and concentrate	2,718	--	
Oxides and peroxides	32	44	All to France.
Metal including alloys:			
Dust	--	20	All to Spain.
Unwrought	r27,328	29,894	Czechoslovakia 21,000; India 6,200;[4] Poland 2,043.
Semimanufactures	r47	83	Jordan 63; Spain 20.
Other:			
Ores and concentrates	17,990	18,178	Hungary 18,171.
Ash and residue containing nonferrous metals	50,401	66,849	Austria 66,595.
Oxides, hydroxides, peroxides	1,166	65,188	United Kingdom 64,121; Japan 292.
Metalloids	2,704	2,571	Japan 2,002; Switzerland 433; West Germany 125.
Base metals including alloys, all forms	20,796	20,897	Czechoslovakia 18,000; Austria 2,550.
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	355	1,782	Saudi Arabia 1,125; Hungary 613.
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	$889	$2,116	United States $1,148; Belgium-Luxembourg $452; Yugoslavia $293.
Grinding and polishing wheels and stones	7	30	Australia 16; Yugoslavia 12.
Artificial corundum	NA	1,089	West Germany 1,058.
Asbestos	r323,640	232,860	Poland 45,217; Hungary 29,163; Japan 28,524; Czechoslovakia 25,468.
Barite and witherite	--	294	Italy 247.
Boron:			
Crude natural borates	3,979	3,215	Japan 3,193.
Boric acid[3]	r10,813	12,760	Hungary 3,010; Yugoslavia 620.
Cement [3] thousand tons	3,548	3,084	Saudi Arabia 673; Hungary 432; Czechoslovakia 321; Yugoslavia 313.
Chalk	483	5	All to Austria.
Clays and clay products:			
Crude:			
Fire clay	7,891	8,297	Poland 8,294.
Fuller's earth, chamotte	26,029	49,367	All to Poland.
Kaolin	22,235	38,905	Poland 28,163; Yugoslavia 10,742.
Other	7,046	4,266	Austria 2,193; Hungary 2,019.
Products:			
Refractory including nonclay brick[3]	129,280	129,812	Cuba 37,096; Romania 22,023; Bulgaria 20,772.
Nonrefractory	5,297	894	Saudi Arabia 496; Ivory Coast 333.
Diamond:			
Gem, not set or strung value, thousands	$380,447	$314,731	Belgium-Luxembourg $211,860; Japan $34,960; West Germany $30,600.
Industrial do	$753	$291	Belium-Luxembourg $160; United States $129.
Diatomite and other infusorial earth	--	114	All to Yugoslavia.

See footnotes at end of table.

Table 11.—U.S.S.R.: Apparent exports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
NONMETALS —Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	293	--	
Phosphatic thousand tons	2,897	3,980	East Germany 1,144; Bulgaria 719; Poland 636.
Potassic	1,998	6,014	New Zealand 5,226.
Manufactured:			
Nitrogenous[3] thousand tons	2,336	2,321	Cuba 510; Czechoslovakia 284; Hungary 249; Turkey 177.
Phosphatic[3] do	703	638	Cuba 262; Bulgaria 182; Hungary 120.
Potassic[3] do	5,771	4,773	Poland 1,538; Hungary 561; Italy 363; Czechoslovakia 344.
Other including mixed do	79	50	Hungary 48.
Ammonia do	547	1,205	United States 705; Italy 249; Netherlands 115.
Graphite, natural	12,180	12,697	Japan 4,734; Poland 3,636; United States 3,306.
Gypsum and plasters	112,484	52,578	Sweden 32,100;[3] Finland 20,340.[3]
Iodine	r35	40	All to Hungary.
Lime	20	56	Do.
Magnesite	17,979	19,383	Hungary 7,163; Netherlands 6,922; Japan 5,095.[3]
Pigments, mineral: Iron oxides, processed	2	24	All to Belgium-Luxembourg.
Precious and semiprecious stones excluding diamond:			
Natural value, thousands	$2,880	$10,321	Switzerland $7,925; Spain $837; Hong Kong $592.
Synthetic do	$1,064	$1,617	Austria $799; Switzerland $290; Hong Kong $201.
Pyrite[3] thousand tons	852	915	Italy 282; West Germany 98; Hungary 83.
Salt[3] do	403	403	Hungary 120; Czechoslovakia 118; Denmark 59.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	849	210	All to Turkey.
Caustic potash	2	--	
Soda ash	45,386	37,293	Italy 28,389; United Kingdom 5,148.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	15,894	19,181	West Germany 9,500; Italy 7,273.
Worked	1,308	1,411	Poland 881; Saudi Arabia 478.
Gravel and crushed rock	46,932	2,394	Hungary 2,200.
Quartz and quartzite	34	--	
Sand not metal-bearing	436	210	All to Hungary.
Sulfur:			
Elemental:			
Other than colloidal	29,606	28,382	Hungary 27,583.
Colloidal	--	2	All to United Kingdom.
Sulfuric acid[3]	162,471	143,676	Czechoslovakia 119,368.
Talc	43	561	All to Japan.
Other:			
Crude	90,690	82,876	Belgium-Luxembourg 27,716; Italy 21,427; Spain 17,720.
Oxides and hydroxides of magnesium, strontium, barium	734	654	United States 214; Belgium-Luxembourg 200.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black[3]	r94,252	102,286	Bulgaria 24,153; East Germany 23,029; Hungary 18,945.
Coal including briquets:			
Anthracite and bituminous thousand tons	17,676	21,730	Bulgaria 4,586; East Germany 4,456; Czechoslovakia 3,246.
Briquets of anthracite and bituminous coal do	888	--	
Lignite and lignite briquets do	48	59	Yugoslavia 47; Japan 8.
Coke and semicoke do	2,661	1,688	East Germany 903; Hungary 522; Bulgaria 262.
Gas, natural million cubic feet	847,662	1,063,760	Italy 292,117; Czechoslovakia 259,385; East Germany 152,919; Poland 140,658.
Peat and peat briquets	167,544	196,118	West Germany 54,086; France 32,001; Austria 22,140.[3]

See footnotes at end of table.

Table 11.—U.S.S.R.: Apparent exports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum and refinery products:			
Crude ____ thousand 42-gallon barrels	r701,658	612,851	East Germany 136,240; Czechoslovakia 136,225; Poland 95,205.
Refinery products:			
Gasoline ____ do ____	37,171	30,293	Netherlands 9,873; West Germany 8,611; Hungary 4,434.
Kerosine ____ do ____	r7,414	3,672	Hungary 1,772; Netherlands 790; Sweden 429.
Distillate fuel oil ____ do ____	114,757	62,304	West Germany 25,968; Netherlands 7,958; France 6,176; Sweden 6,058.
Residual fuel oil ____ do ____	53,919	42,546	Sweden 14,987; Belgium-Luxembourg 4,644; Japan 4,632; Italy 3,920.
Lubricants ____ do ____	1,596	290	Spain 159; Yugoslavia 61; Hungary 41.
Other:			
Liquefied petroleum gas ____ do ____	2,848	8,127	Yugoslavia 7,149; France 486.[3]
Mineral jelly and wax ____ do ____	98	28	Italy 13; Austria 5; United Kingdom 3.
Nonlubricating oils ____ do ____	--	182	Spain 178.
Petroleum coke ____ do ____	1,100	1,115	Italy 567; Japan 312; Spain 215.
Bituminous mixtures ____ do ____	--	(5)	All to Saudi Arabia and Algeria.
Unspecified ____ do ____	r15,693	19,360	All to Poland.
Mineral tar and other coal-, petroleum-, or gas-dervied crude chemicals[3] ____	306,132	313,342	Italy 37,099; East Germany 35,450; France 35,156.

rRevised. NA Not available.

[1]Owing to the lack of official trade data published by the U.S.S.R., this table should not be taken as a complete presentation of the U.S.S.R.'s mineral exports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of the U.S.S.R.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Official Trade Statistics of the U.S.S.R.

[4]Metallgesellschaft Aktiengesellschaft (Metallstatistics) Frankfurt am Main, West Germany.

[5]Less than 1/2 unit.

Table 12.—U.S.S.R.: Apparent imports of mineral commodities[1,2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite thousand tons	3,202	2,826	Guinea 1,935;[3] Greece 642; Yugoslavia 249.
Oxide and hydroxide do	922	938	Hungary 431; Yugoslavia 289; United States 70.
Metal including alloys:			
Unwrought	1,769	1,028	Norway 799; United Kingdom 229.
Semimanufactures	r10,734	8,773	Austria 3,150; West Germany 1,546; Japan 1,387; Yugoslavia 1,310.
Antimony metal including alloys, all forms	810	730	All from Yugoslavia.
Beryllium metal including alloys, all forms	2	--	
Bismuth metal including alloys, all forms	35	--	
Cobalt metal including alloys, all forms	95	1	All from West Germany.
Copper:			
Ore and concentrate	142,486	140,316	Canada 83,092; Philippines 50,633.[4]
Metal including alloys:			
Scrap	117	55	All from Austria.
Unwrought	10,988	14,428	Poland 6,448; United States 2,991; West Germany 2,477.
Semimanufactures	23,324	20,276	Poland 6,898; Yugoslavia 6,749; Japan 3,623.
Iron and steel metal:			
Scrap	r19,372	20,000	All from Mongolia.[4]
Pig iron	r196,502	47,230	Algeria 42,230; Sweden 4,673.
Ferroalloys	3,700	2,998	North Korea 2,818;[4] Brazil 100.
Steel, primary forms	7,973	31,190	West Germany 19,219; France 5,357.
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	r1,305	1,139	Spain 306; Japan 182; Poland 174; West Germany 114.
Universals, plates, sheets do	[3]2,475	2,970	West Germany 1,376; Belgium-Luxembourg 386; Austria 369.
Hoop and strip do	278	300	West Germany 190; Japan 38; Belgium-Luxembourg 20.
Rails and accessories do	1	6	Mainly from Japan.
Wire do	24	32	Belgium-Luxembourg 12; Japan 6; Italy 4; West Germany 3.
Tubes, pipes, fittings do	2,951	3,478	Japan 1,239; West Germany 1,032; Italy 428; Czechoslovakia 400.
Castings and forgings, rough do	3	6	Japan 3; West Germany 2.
Lead:			
Ore and concentrate	87,427	86,099	Ireland 10,571;[4] United States 18,630; Canada 18,100.
Oxides	1,073	1,336	France 664; West Germany 572.
Metal including alloys:			
Unwrought	68,289	87,605	Yugoslavia 20,370; France 17,829; United Kingdom 15,056.
Semimanufactures	37	29	Yugoslavia 17; Japan 9.
Manganese:			
Ore and concentrate	10	--	
Oxides	4,000	5,367	Greece 2,700; Ireland 1,800.
Mercury 76-pound flasks	--	2	All from Japan.
Molybdenum:			
Ore and concentrate	4,370	3,391	United States 2,856; West Germany 347.
Metal including alloys, all forms	89	(5)	All from Japan and Switzerland.
Nickel:			
Matte and speiss	--	4,055	All from Algeria.
Metal including alloys:			
Scrap	34	--	
Unwrought	--	10	France 9.
Semimanufactures	157	42	Italy 23; Japan 12.
Platinum and platinum-group metals including alloys, unworked or partly worked value, thousands	$21,600	$1,519	United Kingdom $791; West Germany $505.
Silver:			
Ore and concentrate do	$5,711	$2,737	All from Canada.
Metal including alloys, unworked or partly worked do	$2,937	$5,556	Switzerland $5,555.
Tantalum:			
Ore and concentrate	11	--	
Metal including alloys, all forms kilograms	--	9	All from Japan.
Tin:			
Ore and concentrate	--	2,100	All from Singapore.
Metal including alloys:			
Unwrought	5,619	12,530	Malaysia 5,760;[3] Bolivia 2,872;[3] United Kingdom 2,148.
Semimanufactures kilograms	2,000	315	Japan 250; Yugoslavia 65.

See footnotes at end of table.

Table 12.—U.S.S.R.: Apparent imports of mineral commodities[1][2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Titanium oxides	1,788	2,684	West Germany 2,260; Japan 400.
Tungsten:			
Ore and concentrate	304	[6]757	All from Netherlands.
Metal including alloys, all forms	46	62	Japan 58.
Zinc:			
Ore and concentrate	98,150	73,729	Canada 26,122; Sweden 16,415; Ireland 15,773.
Oxides and peroxides	159	100	All from United Kingdom.
Metal including alloys:			
Unwrought	37,753	38,473	Poland 13,696; Yugoslavia 12,484; France 4,499.
Semimanufactures	2,522	2,716	Poland 1,694; Yugoslavia 1,022.
Other:			
Ores and concentrates	32,723	NA	NA.
Ash and residue containing nonferrous metals	105	667	All from Japan.
Oxides, hydroxides, peroxides	439	374	Japan 373.
Metalloids	27,063	39,788	Norway 19,169; Yugoslavia 11,894; France 6,668.
Base metals including alloys, all forms	1,465	79	Japan 35; Canada 20; United States 12.
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	--	30	Italy 21.
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	--	$1	All from United States.
Grinding and polishing wheels and stones	[r]2,092	2,629	Italy 672; Austria 561; United Kingdom 528; West Germany 436.
Artificial corundum	NA.	123	Italy 120.
Asbestos	164	3	Japan 2.
Barite and witherite	125,247	95,538	Turkey 86,620; Yugoslavia 6,358.
Boron, crude natural borates	--	4	All from France.
Cement[4] thousand tons	592	345	North Korea 190; Mongolia 28.
Clays and clay products:			
Crude	1,309	1,952	Greece 1,500; Japan 233.
Products:			
Refractory including nonclay brick	30,199	23,838	Japan 5,292; Yugoslavia 4,978; France 4,368.
Nonrefractory	[r]3,990	5,643	Turkey 2,098; Yugoslavia 1,337; Italy 1,223.
Diamond:			
Gem, not set or strung value, thousands	[r]$33	$858	All from Belgium-Luxembourg.
Industrial do	$1,013	$252	Belgium-Luxembourg $192; United Kingdom $59.
Diatomite and other infusorial earth	1,074	1,284	Italy 1,064; Japan 180.
Feldspar and fluorspar	69,857	62,640	Thailand 47,000; Morocco 15,640.
Fertilizer materials:			
Crude, nitrogenous	1,548	NA	NA.
Manufactured:			
Nitrogenous	23,893	40,336	Afghanistan 20,700;[4] North Korea 16,614.[4]
Phosphatic[4]	83,880	76,088	Morocco 63,088.
Potassic	--	1	All from Yugoslavia.
Other including mixed	180	1	All from West Germany.
Ammonia	8	--	
Graphite, natural	150	227	United States 168; France 59.
Gypsum and plasters	863	162	West Germany 67; France 61.
Lime	326	58	All from Yugoslavia.
Magnesite powder[4]	480,664	518,021	North Korea 498,021.
Mica:			
Crude including splittings and waste	[r]537	12	Japan 7; Singapore 5.
Worked including agglomerated splittings	[r]67	(5)	All from Japan and Yugoslavia.
Pigment, mineral: Iron oxides, processed	1,363	662	West Germany 358; Japan 300.
Precious and semiprecious stones excluding diamond value, thousands	[r]$139	$1,863	Switzerland $1,300; France $510.
Salt	55	10	All from France.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	34,334	50,672	Netherlands 16,337; Italy 15,150; United States 10,117.
Caustic potash	52	501	Japan 400; Yugoslavia 100.
Soda ash	425,688	481,272	Bulgaria 445,026; Poland 36,242.
Stone, sand and gravel:			
Dimension stone	1,341	620	Yugoslavia 293; France 270.
Gravel and crushed rock	28,401	126	West Germany 98.
Limestone	161	--	
Quartz and quartzite	30	27	West Germany 22.
Sand:			
Construction cubic meters	[r]30,313	20,463	All from Hungary.
Other, not metal-bearing	1,026	324	Netherlands 300.

See footnotes at end of table.

Table 12.—U.S.S.R.: Apparent imports of mineral commodities[1][2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Sulfur:			
Elemental, other than colloidal thousand tons	640	705	All from Poland.
Sulfuric acid	73,400	66,877	Poland 66,630.
Talc	3,987	2	All from France.
Other:			
Crude	--	2,851	Turkey 2,500; Italy 268.
Oxides and hydroxides of magnesium, strontium, barium	181	3,573	France 3,571.
Halogens	40	41	Japan 40.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	444	91	West Germany 82.
Carbon black	[4]705	[4]960	Japan 530; East Germany 300.[4]
Coal including briquets:			
Anthracite and bituminous coal thousand tons	9,880	9,512	All from Poland.
Lignite	15,600	18,091	Hungary 18,079.
Coke and semicoke thousand tons	[r]709	722	All from Poland.
Gas, natural million cubic feet	[r]355,088	311,066	Iran 220,095; Afghanistan 90,971.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	1	8	Sweden 8.
Kerosine do.	420	499	Hungary 241; Italy 239.
Distillate fuel oil do.	290	193	Hungary 166; Greece 13.
Residual fuel oil do.	15	49	Greece 26; Italy 10; Yugoslavia 9.
Lubricants do.	219	321	Italy 88; France 59; United States 42.
Other:			
Liquefied petroleum gas do.	3	(5)	Mainly from Austria.
Mineral jelly and wax do.	(5)	3	Netherlands 3.
Petroleum coke do.	1,026	634	All from United States.
Bitumen and other residues do.	3	6	Hungary 5; West Germany 1.
Bituminous mixtures do.	24	1	Austria 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	63,351	73,003	Japan 72,900.[4]

[r] Revised. NA Not available.

[1] Owing to a lack of official trade data published by the U.S.S.R., this table should not be taken as a complete presentation of the U.S.S.R.'s mineral imports. These data have been compiled from various sources which include United Nations information, data published by the partner trade countries, and partial official trade sources of the U.S.S.R.

[2] Unless otherwise specified, data are compiled from official trade statistics of the individual trading partners.

[3] Metallgesellschaft Aktiengesellschaft (Metallstatistics) Frankfurt am Main, West Germany.

[4] Official trade Statistics of the U.S.S.R.

[5] Less than 1/2 unit.

[6] In addition to the total of 757 tons, Australia exported to the U.S.S.R. tungsten ore valued at $2,635,000.

COMMODITY REVIEW

METALS

Aluminum.—The Soviet Union, second only to the United States in aluminum production, operated 14 primary reduction plants, with a total probable annual capacity of 2,185 million tons as of January 1981. Estimated production in 1980 was 1.94 million tons (including 150,000 tons of secondary aluminum), a 2.1% increase over the 1979 output. Production of alumina and aluminum fell short of the planned increase[85] because planned goals were not reached at the Krasnoyarsk, Regar, Kirovobad, and several other plants, and output did not start at the new potline at the Tadzhik plant.

During the 1966-75 period, the output of aluminum grew by 220%. Under the 1976-80 5-year plan, output in 1980 was scheduled to be 20% to 30% above the 1975 level; the regions east of the Urals were to account for the entire increase. To achieve the goals, it was planned to put into operation several potlines at the Tadzhik and Sayansk plants and to complete construction of the Krasnoyarsk plant in Siberia. It was also planned to accelerate construction of additional alumina facilities at the Bogoslovsk and Uralsk plants in the Urals and at the Kirovabad plant in Azerbaydzhan. The Nikolayev alumina plant, with an annual capacity of 1 million tons, was to be completed by 1980. Due to slow construction and delays in the delivery of equipment, construction of the first half of the Regar plant in Tadzhikistan, the first potline at the Sayansk plant, and the Nikolayev alumina plant were not completed in 1980.

According to the 1981-85 5-year plan, output of aluminum in 1985 is scheduled to be 15% to 20% above the 1980 level. The

completion of construction of the Tadzhik aluminum and Nikolayev alumina plants and startup of several potlines at the Sayansk plant in Siberia are planned for this period. It is also planned to put into operation additional alumina facilities at the Bogoslovsk and Uralsk aluminum plants in the Urals.

Expansion of the Soviet aluminum industry has continued over recent years with the assistance of foreign technology and imported bauxite and alumina. During the 1976-79 4-year period, Soviet production of primary aluminum increased by 9.6%. Production of primary aluminum at the Bratsk plant increased by 110% during the 1971-75 5-year period and only by 13.1% during the 1976-79 4-year period. Production capacity of the Krasnoyarsk plant has attained only 75%.[86] In 1979, a big overuse of power took place at all Soviet aluminum and alumina plants, in particular at the Bratsk and Novokuznetsk aluminum plants and at the Achinsk alumina plant.

Table 13.—U.S.S.R.: Estimated capacity and production of primary aluminum plants in the U.S.S.R.

(Thousand metric tons)

Plant	Operations began	Probable output 1980	Probable annual capacity Jan. 1, 1981
Bogoslovsk	1945	120	140
Bratsk	1966	480	540
Dneprovsk	1933	60	70
Irkutsk	1962	200	240
Kanaker	1950	55	70
Kandalaksha	1961	20	30
Krasnoyarsk	1964	300	390
Nadvoitsa	1954	25	35
Novokuznetsk	1943	135	160
Regar (Tadzhik)	1975	100	160
Sumgait	1955	60	70
Uralsk	1939	120	135
Volkhov	1932	15	20
Volgograd	1959	90	125
Total		1,780	2,185

Aluminum is produced more for export than for domestic consumption, and the U.S.S.R. has exported over 500,000 tons in each of the 7 past years. Primary and secondary aluminum is exported to European countries, Japan, and the United States. Exports are expected to increase to CMEA countries.

Construction continued at the Krasnoyarsk, Regar (Tadzhik), and Sayansk primary aluminum plants and at the Nikolayev alumina plant. Construction of the Krasnoyarsk plant, the second largest aluminum plant in the country, is nearing completion. The No. 4 potline at the Regar plant was commissioned in March 1980, 3 months behind schedule. With the commissioning of this potline, the production capacity of the plant will be increased by 25%. The No. 5 potline at this plant went onstream on December 29, 1980, and was officially commissioned in January 1981. The third (final) stage of the plant for production of baked anodes at the Regar aluminum plant was completed in July 1980. Domestic anodes were used here for smelting metal for the first time in October 1978 with the startup of the first stage of the plant. Renovation of potlines at the Bratsk plant started in 1978 and is to be completed during the 1981-85 period. The first potline at this plant was commissioned in 1966 and the last one (No. 18) in 1976.

The first potline of the Irkutsk aluminum plant was brought onstream in 1962 and the last one (No. 8) was put into operation in 1971. The total probable capacity is 240,000 tons per year, and probable output is 200,000 tons in 1980. The planned capacity of this plant is to increase by 20% to 25% during the 1981-85 period. The plant's raw materials come from the Urals; its output consists of aluminum wire and ingots, of which about one-third is exported.

Reportedly, a consortium headed by KHD Humbolt Wedag of Cologne, FRG will build a $292 million aluminum anode plant in conjunction with construction of the Sayansk 400,000- to 500,000-ton-per-year smelter in Siberia. The first of five potlines at the smelter is scheduled to begin operation early in 1984.

Although the Soviet Union is a large producer of low-grade bauxite, supplies are insufficient and it is developing alumina production from nepheline and alunite. The alumina is produced in the U.S.S.R. only at the Volkhov aluminum plant and at the Pikalevo complex in Leningrad Oblast', from the 1.5-million-ton nepheline concentrates of the apatite complex at the Kola Peninsula, and at the Achinsk alumina plant from nepheline rock in Siberia. In 1980, over 82% of primary production was derived from bauxite, 16% from nepheline, and less than 2% from alunite. The amount of alumina produced from nepheline increased 4.7 fold between 1968 and 1978. Flotation nepheline concentrate containing 29% Al_2O_3 originates from the Kola Peninsula. Contruction of the nepheline concentrator No. 2, with a capacity of 4

million tons per year of concentrate (2.5 fold more than the No. 1 concentrator) at Kola Peninsula began several years ago. The Ministry of Chemical Industry built one nepheline concentrate plant with a 1.5-million-ton-per-year nepheline concentrate capacity and spent 23 million rubles on a second 4-million-ton-per-year plant before being told by the Ministry of Nonferrous Metallurgy that the nepheline concentrate was not suitable for making alumina. Further construction of this plant is being converted as an apatite concentrate plant.[87]

The long-range development program provides for a major increase in alumina production by the Nikolayevsk plant and by the expansion of the facilities of the Uralsk, Bogoslovsk and other plants. The first stage (with a capacity of 250,000 tons per year) of the 1-million-ton-per-year Nikolayevsk plant, on the Black Sea, went onstream in September 1980, about 9 months behind schedule. The second stage, with technology from France's Pechiney Ugine Kuhlmann, which was due for completion by December 31, 1980, has been rescheduled for 1981. The plant is being built in four equal stages. The plant has a 500,000-ton bauxite depot in operation. It will use Guinean and Yugoslav bauxite. The stock of imported bauxite at the Dneprobug Seaport is enough for 1 year of production of the No. 1 stage.

The Achinsk alumina from the nepheline plant in Krasnoyarsk Kray has not been operating satisfactorily. The plant has not met its production quota for any of the past 10 years since it went onstream. The main causes of lagging production are technological problems in the production of alumina from nepheline, inefficient repair work, and poor management.

Major reserves of presently minable bauxite are situated in the Turgay in Kazakhstan, on the eastern slopes of the Urals, and in the Tikhvin area of the Leningrad Oblast'. About 75% of the reserves are in the Asian part of the U.S.S.R. Bauxite is the main source of alumina in the U.S.S.R., although there are from 8% to 20% alumina losses during the processing of bauxite. Large quantities of high-grade bauxite and alumina have been imported from Guinea, Greece, Yugoslavia, Hungary, India, and other countries. Because of the depletion of bauxite at Boksitogorsk (Tikhvin area of the Leningrad Oblast'), it is planned to supply the Boksitogorsk alumina plant with bauxite from the Severoonezhsk deposit. Also, the development of the Sredne-Timan bauxite deposit in the Timan-Pechora region is planned during the 1981-85 period.

In 1980, the U.S.S.R. operated 15 secondary aluminum units with a total estimated annual capacity of 190,000 tons and produced an estimated 150,000 tons of secondary aluminum and its alloy.

According to an agreement, the Kindia bauxite complex in Guinea has been financed by the U.S.S.R. and built with Soviet technical assistance. The enterprise, with a capacity of 2.5 million tons per year of bauxite, has been setup on a compensation basis. Reportedly, the agreement has been signed for Soviet participation in the construction of an alumina plant in Jamaica. The U.S.S.R. is to receive 250,000 tons per year of alumina from this plant. It is planned to construct the Andhara alumina plant in India with Soviet assistance. The initial capacity of 600,000 tons per year of alumina is to be expanded later to 1 million tons. Half of the production is destined for the U.S.S.R. as repayment for technology, equipment, and financing. Greece and the U.S.S.R. have reached an agreement in principle on construction of an alumina plant in Greece. The Soviet Union has agreed to purchase at least 50% of the production for a period as repayment for the assistance to Greece in the construction of the plant.

Antimony.—The Kadamzhay complex in the Kirgiz S.S.R. is the principal antimony center, where integrated facilities produce most of the country's refined products. Output at this complex was to increase by 50% in the 1976-80 5-year period.

Construction of the new Aznob mine and mill unit (Dzhidzhikrutskiy complex) in Tadzhikistan continued slowly in 1980. Completion of the first stage was scheduled for 1975, but is now rescheduled for 1981. Deposits of antimony also occur in Kazakhstan and Sarylakh and Tazhdolinsk in Siberia. Production of antimony at the Ust'-Kamenogorsk lead-zinc complex increased slightly in 1980. Detailed exploration of the Novoye antimony-mercury deposit in Kirgiziya continued in 1980. The wholesale price of antimony in the U.S.S.R. is: SUOO-2,350 rubles per ton; SU2-1,850 rubles per ton. It is planned to recover antimony by processing lead scrap.

Arsenic.—Arsenic ore reserves are estimated at 12 million tons, containing 0.2% to 0.5% As_2O_3. Small arsenic deposits are located in Tadzikistan, but all output in 1980 was obtained as a byproduct from the

smelting or roasting of metallic ores. The only plant in the U.S.S.R. to recover arsenic from sulfur has been installed at the Mednogorsk copper and sulfur complex in Orenburg Oblast'. The Ust'-Kamenogorsk lead-zinc complex decreased production of arsenic in 1980.

Beryllium.—The Soviet Union continues to be one of the world's largest producers and consumers of beryl, beryllium alloys, and metal. Beryllium is found in variable quantities in most of the pegmatites all over the U.S.S.R. There are numerous deposits mainly in the Kola Peninsula, Kazakhstan, the Urals, Altay, Transbaykal, the Soviet Far East, and Western Ukraine. Domestic reserves are more than adequate. Production is being expanded and the probable level in 1980 was 1,800 tons of beryl (10% to 12% BeO). It is planned to recover beryllium from the Dzhidinsk tungsten and molybdenum ores in Buryat A.S.S.R.

Bismuth.—Bismuth is recovered as a by-product of lead and zinc smelting in Kazakhstan and other areas in the Soviet Union, from dust and crude metal at the Balkhash, Kirovgrad, and Mednogorsk copper complexes, and from tungsten and molybdenum ores. Estimated production for 1980 was 72 tons, the same as in 1979. Two copper-bismuth deposits (Taryzkan and Kantarkhana) are under exploitation in Tadzhikistan. The Ustarassy Mine in the Chatkal Mountains is the only enterprise to mine bismuth ore. Its concentrates are shipped to the Chimkent lead plant in Kazakhstan for processing.

Renovation and enlargement of bismuth production facilities at the Dalpolimetall lead complex in the Primosk Kray began in 1979. In 1980, the complex was to begin receiving bismuth-bearing ores. Production of bismuth at the Ust'-Kamenogorsk lead-zinc complex declined in 1980.

Cadmium.—Cadmium is produced at various lead and zinc smelters and at some copper complexes as a byproduct. Estimated production in 1980 was 2,850 tons, the same as in 1979. Kazakhstan continues to be the national leader both in reserves and production, and the Leninogorsk polymetallic complex there is one of the largest producers. The Ust'-Kamenogorsk lead-zinc complex decreased output of cadmium in 1980.

Chromium.—With an estimated output of 2.45 million tons, the U.S.S.R. continued to be the world's second producer and exporter of chromite in 1980. Estimated exports totaled 0.75 million tons during the year, with about 75% destined for centrally planned economy countries. Approximately 70% of the output was consumed or stocked in the Soviet Union. Based on 1978 data, Soviet consumption of chromite was distributed as follows: Metal production 45%, refractories 35%, chemical and other products 20%. Soviet-reported production of crude chromium ore was 3.2 million tons in 1979 and 3.4 million tons in 1980.[88]

Chromium ores are situated at Kazakhstan and in the Ural Mountains. The Donskoye operation at Khrom-Tau in Western Kazakhstan, which produces 95% of the Soviet output, is the only supplier of high-quality ore. Deposits in the Ural Mountains have a low chromium oxide content (20% to 40%), as well as a low Cr_2O_3:FeO ratio. These are mostly used in the chemical and refractories industries. It was planned, during the 1976-80 period to put into operation new facilities for production of 2.55 million tons per year of crude ore. However, only the first stage of the underground Molodezhnaya Mine, with a capacity of 0.8 million tons per year of crude ore was put into operation in November 1980. The total planned capacity of the mine is 3 million tons per year of crude ore. Development of the open pit at the "40-years of Kazakh S.S.R." mine is nearing completion. For transportation of overburden, M-120 Unit Rig dump-trucks (109-ton capacity) are used.

Currently, the south Kempirsay chromite deposits are being mined by the Ob'yedinenyy Mine (Millionnyy, Gigant, and Geofizicheskiy open pits), the 20th anniversary of the Kazakh S.S.R. Mine (Yuzhnyy open pit), and the 40th anniversary of the Kazakh S.S.R. Mine (open pit of the same name and the Molodezhnaya underground mine, which is under development). Besides these large deposits, the small shallow Spornoye, No. 16, No. 38, No. 29A, and Geofizicheskoye V deposits are currently being mined or are under development for surface mining. For the mining of deep parts of the "Millionnoye," "Almaz-Zhemchuzhina," "Pervomayskoye," and No. 21 deposits, the Tsentral'naya underground mine will be developed. Mines for the extraction of chromite ore from a maximum depth of 1,200 meters are under development at the Donskoye mining and concentration complex in Aktyubinsk Oblast'. The complex overfulfilled production quotas for the 1976-80 years.

Marketable ores include those with a

chromium oxide content of at least 45%, a maximum silica content of 10%, and a maximum lump size of 300 millimeters. Ore preparation at the Donskoye mining and concentration complex consists of crushing, grading, and handpicking. Rich and lean ores are blended. From 1974 through 1978 (the first stage of the plant began operation in 1974), 1,556,000 tons of feed material with a chromium oxide content of 42.8% was processed and 973,000 tons of concentrate with a chromium oxide content of 50% to 56% was obtained. Design capacity of the gravimetric concentrator is 1 million tons per year of feed.

During the 1976-77 period, the concentrator's marketable output increased by 110%, reaching 435,000 tons, with an average chromium oxide content of 49.8% in 1978. It was planned in 1978 to put into operation additional annual capacities of 700,000 tons of crude ore, to accelerate development of the Molodezhnaya underground mine, and to attain the planned output of the concentration plant by producing 575,000 tons of concentrate (30% over the 1977 level) with an average chromium oxide content of 50.8%. These targets were not met, however. Output of marketable chromite from the Saranov underground operation in the Urals is estimated at about 5% of the total Soviet production or about 140,000 tons.

Cobalt.—Gross cobalt reserves are estimated at about 100,000 tons of metal content, chiefly in nickel-cobalt ores and in cobalt ores of the Khovu-Aksinsk deposit in Tuva Autonomous Republic. Production continues to be concentrated at Norilsk in East Siberia; at Monchegorsk and Pechenga on the Kola Peninsula; in the Urals at the Yuzhuralnikel, Ufaley, and Rezhsk plants; and at a number of copper plants. During the 1976-80 5-Year period, Norilsk became the main supplier of cobalt. Recovery of cobalt remains low, especially from the copper pyrite ores of Bashkiria. The planned production cost of cobalt in concentrate at the Pechenganikel complex was 6,780 rubles per ton.

Cobalt production rose by 16% between 1970 and 1975, and was probably increased by a similiar amount during the 1976-80 period. In 1980, the U.S.S.R. produced an estimated 3,650 tons of cobalt, or about 1.5% over the 1979 level. The planned 5.8% increase of cobalt production at the Norilsk complex was not met in 1979. Since the beginning of 1976, capacity of the Tuva cobalt complex almost doubled as a result of renovation. During the 1981-85 period, cobalt production is to increase by no less than 30%.

Copper.—In 1980, the Soviet Union produced an estimated 1 million tons of blister, including 95,000 tons of secondary copper from 13 smelters with a total probable annual capacity (Janaury 1981) of 1.13 million tons. The secondary blister copper is produced by the Kirovgrad smelter in the Urals, by the Moscow smelting and electrolytic plant, and by several small units of secondary nonferrous plants. There are 11 refineries in operation. Exports of copper increased from 123,000 tons in 1970 to 205,618 tons in 1975. Estimated exports in 1980 were 240,000 tons.

Under the 10th 5-year plan, output of copper in 1980 was scheduled to be 20% to 30% above the 1975 level. The plan provided for 80% of production to come from the Asian part of the U.S.S.R. by 1980. The 1976-80 plan called for a 25% increase in refined copper production in Kazakhstan. However, the planned targets for copper production in this Republic were not met for this period; instead, the increment was only 14%. Under the 11th (1981-85) 5-year plan, output of copper is scheduled to be 20% to 25% over the 1980 level. It is planned to increase production of copper at the Almalyk complex in Uzbekistan, and to complete construction of the second stage of the Zhayremsk mining and concentration complex as well as to start development of the Annenskiy and Akchiy-Spassk Mines of the Dzhezkazgan complex. Production is estimated at a probable 1.15 million tons in 1985 and 1.30 million tons in 1990.

The country operates 40 concentrators with a total probable annual capacity of about 5 million tons of concentrates. Production of concentrates in 1980 has been estimated at 4 million tons with an average copper content of about 20% (from 12% to 36%). Sixty-five underground mines and open pits produced an estimated 126 million tons of ore in 1980. Approximately 80% of all ore was mined by open pit methods. Up to 10% of primary copper is produced as a byproduct.

The main copper ore regions are located in central and eastern Kazakhstan, the eastern slope of the Ural Mountains, Uzbekistan, the Transcaucasus, Eastern Siberia, and Norilsk. Among other regions containing copper deposits of lesser importance are the Northern Caucasus, Western Siberia, and the Kola Peninsula. Kazakhstan

contained about half of the total copper reserves in 1980 and produced 30% of the Soviet total copper output.

Gross copper reserves of the country in 1979 are estimated at 3,600 million tons (average 1.1% Cu). The reserves are chiefly in low-grade cupriferous sandstones and porphyrites but also include several million tons of high-grade pyritic-polymetallic ores, copper-nickel ores, and smaller quantities of copper-molybdenum and other miscellaneous ore types. The gross reserves of the Udokan copper deposit in Eastern Siberia, which has not yet been exploited, amount to over 700 million tons averaging 1.15% Cu (20% oxides, 80% sulfides). It is planned to develop this deposit in 1981-90. The Soviet Union has been negotiating periodically with British, French, and Japanese companies to develop "jointly" the Udokan deposit.

Gold.—Since the early 1930's, little data on Soviet activities in precious metals exploration, production, trade, and stockpiles have been published officially. Available information, however, indicates that in 1980 the U.S.S.R. was probably second among world producers with output estimated at 260 tons, or about 2% above the 1979 level. Over two-thirds of the gold output is from the Soviet Far East and East Siberia (mainly from placers at Kolyma, Aldan, Dzhugdzhur, Indigarka, Yana, and Chukotka); the balance comes mainly from gold and polymetallic ores in the Urals, Kazakhstan, Armenia, Uzbekistan, and West Siberia. However, substantial quantities are also produced as byproducts at nonferrous operations. The biggest sources of byproduct gold in the U.S.S.R. are copper and lead-zinc ores.

Soviet gold production has maintained a steady annual growth rate of about 2%. Prompted by the higher international prices, the U.S.S.R. plans to increase production and has been importing large-scale equipment from West Europe, the United States, South Africa, and Japan. Based on ore reserves, geological and mining conditions in the country's largest gold-producing regions, and fragmentary, indirect reporting, production is estimated at 275 tons in 1985; yet the quota for gold production was not met in 1980. Poor work results were achieved by almost all mining administrations of the Severovostokzoloto association.

Soviet gold holdings are secret, and current production does not automatically reach the world market for gold. Soviet sales are conditioned by both economic and political considerations. Throughout the 1970's, the U.S.S.R. has managed its gold sales to the West carefully, and it is likely that this policy will continue. Official gold sales are declining as prices increase. Also, in the past, gold sales have been occasionally used to finance emergency grain imports.

Dealers estimate Soviet gold sales in 1980 at 80 tons, about 40% of the 1979 figure. Soviet gold enters the markets mainly in Zurich, Frankfurt, and London. Soviet gold and platinum-group metal sales strategy will be critical in shaping world prices of the 1980's.

Potential reserves of gold in ore were estimated at about 6,200 tons in 1979. Although Soviet sources report reserves sufficient for 12 to 15 years at the present rate of production, extensive prospecting continues. Several big mines are suffering from lack of reserves and new mines have been opened in the northeastern parts of the Soviet Far East and the Yakut A.S.S.R. In view of the importance of gold, an intensive search is in progress in the Asian part of the country. It is planned to construct the first stage of the gold mining and concentration complex in Kirgiziya during the 1981-85 period.

Magadan Oblast' is the main producing center with 35 placer mines, 23 dredges, over 500 sand-washing rigs, and about 1,500 bulldozers. Construction of the Dukat complex in the Omsukchansk county of this Oblast' started 12 years ago, and it was put into operation only in January 1980. There was a shortage of earthmoving equipment and some machines were idle for lack of spare parts, while others were undergoing repairs at the Vostokzoloto association plants for a long time. The 1976-80 5-year targets for discovery of gold deposits at the Severovostokzoloto association was not met, but the 1976-80 quotas for gold production in the Chukchi Autonomus Okrug was reportedly overfulfilled.

The development of the Muruntau deposit in Uzbekistan, which was discovered in 1960, continued in 1980. The Muruntau open pit was over 100 meters deep in 1980 and the overburden:ore ratio was 35:1. Estimated output of gold at the Muruntau complex in 1980 was 27 tons. Special attention was paid in 1980 to improving technology of gold recovery at the Ararat plant in Armenia, which is fed by ores from the Zod deposit. In Yakutia, the second largest gold-producing region, the Lenzoloto Trust was

the leading gold-dredging enterprise. The deepest shaft (890 meters) in the Soviet gold mining industry was under development at the Bestube Mine in the Tselinograd Oblast' in Kazakhstan.

Iron Ore.—In 1980, 71 underground mines and 59 open pits, with a total estimated capacity of over 300 million tons of usable iron ore, produced 245 million tons of direct shipping ores plus concentrates (crude ore over 500 million tons), an increase of 3 million tons compared with the 1979 level. Production of usable ore was scheduled to reach 276 million tons (crude ore 560 million tons) in 1980, according to the 5-year plan. There were 92 iron ore concentrators, of which 29 had sinter facilities and 7 had pelletizing facilities in operation (Sokolov-Sarbaysk, Kachkanar, Lebedinsk, Kremenchug, and 3 in Krivoy Rog) with a total estimated annual capacity of 52 million tons. Output of pellets was estimated at 45 million tons in 1980, compared with the original 5-year plan target of 62 million tons.

During the 1976-79 period, new facilities were constructed for an annual production of 108 million tons of crude iron ore, or 60 million tons of usable ore. Of this amount, a 40-million-ton capacity for crude iron ore production replaced depleted facilities. At the Mikhaylovsk mining and concentration complex in Kursk Oblast', the No. 13 section, with 0.8 million tons per year of iron concentrate (1.5 million tons of crude ore), was commissioned in November 1980. New facilities for production of 1.7 million tons of iron concentrate at the Lebedi complex in Belogordskaya Oblast', went into operation in August. This is the second plant at the complex with the same capacity. The complex now has the capacity to process 23 million tons of crude ore annually. The second stage of the No. 2 pelletizing plant at the Dneprovsk complex, with an annual capacity of 3 million tons of iron pellets, was commissioned in November. At the Cherepovets metallurgical plant a new sintering section, with a 2-million-ton-per-year capacity of raw material, was commissioned in November.

The Severnyy mining and concentration complex in Krivoy Rog has become the biggest enterprise in the country for production of iron ore concentrate. The last stage of the new concentration plant was commissioned on April 4, 1980, its annual production capacity is 7.69 million tons of concentrate. The fifth stage of the Olenogorsk mining and concentration complex in Murmansk Oblast', with a capacity of 1,275,000 tons per year of iron concentrate, was commissioned in July. The total annual capacity of five stages is about 6 million tons of concentrate. The first stage of the Yubileynaya Mine in Krivoy Rog was commissioned in December. The design capacity of the mine is 4 million tons per year of crude iron ore. Sinking of the 620-meter-deep first shaft at the Yakovlevo Mine in Belgorodsk Oblast' was completed in April 1980.

Exports of iron ore increased from 36.1 million tons in 1979 to 40 million tons in 1980, principally to CMEA countries. Although a large exporter of iron ore, the U.S.S.R. has continuous problems supplying its own plants, both quantitatively and qualitatively.

The iron content in crude iron ore decreased from 50% in 1950 to 44.5% in 1960, 37.3% in 1970, and 35.1% (planned) in 1980. As a result, the ratio of ores subject to beneficiation increased from 37% in 1950 to about 87% in 1980.

Open pit mining is used in about 74% of the total volume of usable iron ore. In 1980, there were 10 pits, 150 meters or more deep; 16 pits over 200 meters deep (250 to 300 meters at the Sokolovskiy, Sarbayskiy, and other pits). The main underground mining regions are the Krivoy Rog Basin in the Ukraine (60%), the Gornaya Shoriya in Western Siberia (16.7%), and the Tagilo-Kuvshinskiy region in the Urals (16.4%).

The total iron ore reserves in place in the $A+B+C_1+C_2$ categories are 111,000 million tons (as of January 1, 1976), averaging 34.8% iron. These were distributed, as follows: The Ukraine (31%), European Center (24.4%), Urals (15.7%), Kazakhstan (15.0%), Siberia (7.4%), Northwest (3.0%), Soviet Far East (2.5%), and others (1%). Total national reserves in categories $A+B+C_1$ were estimated at 60,200 million tons, averaging 38% iron. This figure included 10,300 million tons of ore, averaging over 55% iron, which does not require dressing, and 34,800 million tons of easily dressed iron ore.

The Ukraine produced over 50% of Soviet iron ore and the Krivoy Rog Basin produced about 89% of the Ukraine's total in 1980. The Kursk region was the second largest producer, followed by the Urals, Kazakhstan, Siberia, and the Kola Peninsula. There were 23 underground mines (10 mining administrations), 9 large and several small open pits in operation in Krivoy Rog in 1980.

Over 40 million tons of crude iron ore were produced in the Kursk region in 1980. It was planned to reach 47 million tons by 1980. There were four iron ore producing enterprises in this region in 1980: The KMAruda complex, the first stages of the Lebedin and Mikhaylov complexes, and the Stoylensk open pit. Development of the Yakovlevsk underground mine, which began in 1974, is proceeding slowly, and the sinking of the second shaft (700 meters deep) started in 1979. The Lebedin complex did not meet production targets for any year of the 1976-80 period.

There are shortages of iron ore in the Urals and over 10 million tons of ore are shipped annually to the Urals from KMA and other regions of the country. Iron ore production in Kazakhstan accounted for 9% of the total, mainly from the Sokolov-Sarbay complex, with an annual capacity of about 30 million tons of crude ore (13.4 million tons of concentrate and pellets).

According to an October 1973 agreement, Finnish companies are building the Kostamush iron ore complex in Soviet Karelia about 30 kilometers from the Finnish border. This project will be built in three stages and will have an annual capacity of 8.9 million tons of pellets (24 million tons of crude ore). Construction of the first stage for the production of about 3 million tons of pellets per year began in 1977 and will continue until 1982. Finland will buy up to 1.2 million tons of pellets per year during the 1983-90 period. The deposit contains an estimated 1,200 million to 1,500 million tons of ore with an average iron content of 31%. Construction will take from 8 to 10 years. When the first stage is completed, production will be 2.96 million tons of pellets annually from 3.25 million tons of concentrate (8 million tons of crude ore). Mining of iron ore on a limited scale started at the Kostamush complex in 1980. For the time being, the ore will be stockpiled.

Iron and Steel.—In 1980, the Soviet iron and steel industry held first place in the world in total quantity of iron ore, coke, refractories, crude steel, ferroalloys, and steel pipe production. However, while the Soviet Union is the largest steel producer in the world, it may also waste more steel than any other country. According to the various published accounts in the Soviet press, the Soviet industry in 1980 used only 73% of the rolled steel that it consumed, with the remaining 27% being wasted. There is also considerable waste in the production of steel. A careful and exhaustive study of Soviet publications show that only about 45% of the total crude steel production is efficiently used in the Soviet economy; 55% is remelted or lost.

Despite the great volume of steel production, the lack of suitable metal limits the development of the economy, and the country became a net importer of efficient rolled steel products in 1978. There are nine main reasons for such a situation:

1. Slow realization of basic qualitative changes in metallurgy itself and a lag in introducing new technological processess into metal-consuming sectors of the economy.
2. Rolled metal products are often turned out with deviations from standards and technical specifications.
3. Rolled metals do not undergo supplementary treatment and do not acquire new qualifications. According to calculations made by Soviet scientists, about 10 to 15 million tons of metal each year are carried away or eaten up by corrosion. Metal needs to be protected.
4. In many construction projects, there have been delays in putting new equipment into operation. The chronic troubles facing the construction work have been project completion delays, a diminishing number of planned projects, higher construction costs, and excessive consumption of labor and materials.
5. The new projects have not achieved design capacities for a long period of time.
6. There is a lack of reserve production equipment. Between 50% and 60% of the main units of metallurgical equipment used in the period from 1966 to 1980 were operated beyond their rated limits.
7. There have been problems in the supply of raw materials. Currently the biggest problem facing the Soviet Union is railway transportation. The iron and steel works in the coal-rich Ukraine area are in need of coking coal. The Donets coal basin can no longer ensure a coking coal supply for the local iron and steel works. The supply has to come from the Kuznetsk in Siberia and Karaganda Basin in Kazakhstan.
8. Negligence is tolerated in the storage and utilization of metal.
9. Significant losses are caused by mismanagement in storing and dispensing metal products.

The 10th 5-year plan called upon the steel industries to increase output both quantita-

tively and qualitatively. Production of crude steel was to increase from 141.3 million tons in 1975 to between 160 million and 170 million tons in 1980. Soviet crude steel output in 1980 was 148 million tons and was 1.1 million tons down from 1979. Production of finished rolled steel was to increase from 98.7 million tons to between 115 million and 120 million tons. Actual production of finished rolled steel in 1980 was 103 million tons, 0.2 million tons below that of 1979. The 11th 5-year plan (1981-85) calls for increased production of finished rolled steel from 103 million tons in 1980 to 117 million to 120 million tons in 1985.

In 1980, 36 enterprises, operating 138 blast furnaces, produced an estimated 108 million tons (revised planned quota 114.2 million tons) of pig iron, 1% less than that of 1979. The average blast furnace capacity increased from 1,135 cubic meters in 1971 to 1,258 cubic meters in 1979. About two-thirds of all blast furnaces use oxygen for enrichment; over 83% of the pig iron was produced by partial use of natural gas, and 75% was produced by use of oxygen.

Crude steel production from 76 metallurgical works decreased by 0.7%, from 149.1 million tons in 1979 to 148 million tons in 1980 (revised planned quota 157 million tons). There were 42 oxygen converters (including 9 with a capacity of 250 to 300 tons) in operation in January 1981.

Soviet finished rolled steel product output in 1980 totaled 103 million tons (planned quota 107 million tons), a decrease of 0.2 million tons compared with that of 1979. It is planned to produce 117 million to 120 million tons in 1985.

In terms of tonnage, the Soviet Union was the largest world producer of steel pipe, with a total of 18.2 million tons in 1980. The gas industry has consumed about 4 million tons of steel pipe (including over 3 million tons of 530- to 1,420-millimeter pipe). Construction of facilities for pipe production continued at the Vyksa metallurgical plant in Gor'kiy Oblast'. Pipe developments in the U.S.S.R. include the construction of a new 15,700-ton-per-year pipe mill at the Azerbaydzhan plant and the 320,000-ton-per-year mill at the Severskiy plant in Sverdlovsk Oblast'.

Lead and Zinc.—With an estimated output of primary lead at 525,000 tons and zinc at 785,000 tons, the U.S.S.R. was probably the world's second largest producer in 1980. Estimated output of secondary metal was 100,000 tons of lead and 80,000 tons of zinc. Estimated primary production in 1985 is 550,000 tons of lead and 820,000 tons of zinc. Lead exports increased from 92,400 tons in 1970 to an estimated 100,000 tons in 1980 and zinc exports from 95,100 to 100,000 tons over the same period. The Soviet Union imported an estimated 80,000 tons of lead and 70,000 tons of zinc in 1980. Reportedly, under the 1979-80 2-year contract, Cyprus Anvil Mining will supply about 15,000 tons each of lead and zinc concentrates.

During the 1966-77 period, output of zinc increased by 80%, but neither lead nor zinc output quotas were reached in 1980 nor in previous years, owing to the slow construction of new facilities, poor supplies, and low metal recoveries.[89] Over 10% of the total lead and zinc production was recovered as a byproduct in 1980. The lead content of mined ores has declined by 0.2% in recent years. Despite of this, however, recovery of lead into concentrate has increased.

The metal content of ore reserves was estimated in 1980 at 16 million tons of lead and 20 million tons of zinc; over two-thirds are located in Kazakhstan, chiefly in the Altay region and in the district of Kara-Tau. There are also large reserves of zinc in the Urals. Exploration of the Uchkulach lead and zinc deposit in Uzbekistan, Chekmar' in Kazakhstan, and Kholodninskoye in Buryat A.S.S.R. continued in 1980. An exploration shaft was being sunk at the Achisay polymetallic complex in Kazakhstan.

Kazakhstan continues to be the leading lead and zinc producer, followed by the Urals, Uzbekistan, Siberia, North Causcasus, and the Ukraine. Production of zinc in Kazakhstan increased by 80% and that of lead by 32% during the 1967-76 period. Kazakhstan produced 50% of zinc and over 70% of the total lead in 1980. The planned quotas for lead and zinc production in Kazakhstan for the 1976-80 period were not met.[90]

The future development of the ore base and Altay region in East Kazakhstan is of serious concern to Soviet officials. The output of polymetallic ores has increased fourfold in the past 10 years, but grades have dropped by 40%. A 20% increase in the output of mined ore was reported at the Zyryanovsk complex with a 25% drop in lead-zinc content.

In the Urals, the second largest zinc producing region, the problem of zinc and gold recovery from the copper-pyrite ores remains unsolved. Slow development of the

mines in the Urals has resulted in shortages at the concentrators. The recovery of zinc in zinc concentrates from copper-zinc ores is on the average only 60%. There are also shortages of lead-zinc reserves at the Sadonsk deposit in North Caucasus. This is the main supplier to the Elektrotsink zinc plant in Ordzhonikidze. Development of the new mining facilities at the Adrasmansk lead-zinc complex in Tadzhikistan are behind schedule.[91] The first stage of the Nikolayevsk lead-zinc mine in the Soviet Far East went into operation in 1980.

Magnesium—Five magnesium plants, with an estimated combined annual capacity of 85,000 tons, produced 74,000 tons in 1980, 3% more than in 1979. Exports of metal increased from 11,380 tons in 1975 to an estimated 15,000 tons in 1980. Production and consumption of rolled metal in the U.S.S.R. is small. Reportedly, over the years of the ninth 5-year plan (1971-75), the output of magnesium and its alloys increased 20.2%. According to the 1976-80 plan, output of magnesium and its alloys was to increase by 23.8% to 74,000 tons compared with an estimated 60,000 tons in 1975.

Manganese.—The Soviet manganese industry remains the largest in the world, with an estimated output of 10.25 million tons (over 23 million tons of crude ore with an average of 23.4% Mn), the same as in 1979. Planned production quotas for 1980 were 10 million tons of marketable ore (23.4 million tons of crude ore), about 80% of the total came from the Nikopol' Basin in the Ukraine, and the rest from the Chiatura Basin in Georgia. About 300,000 tons of crude ore were produced in Kazakhstan. During the 1976-80 period, new facilities for production of 6.36 million tons of crude ore were to be put into operation. Estimated production of marketable ore in 1985 is placed at 12 million tons. During the 1981-85 period, the greatest increase in manganese ore output will be from open pit mining in the Ukraine.

Exports of manganese ore increased from 1.32 million tons in 1979 to an estimated 1.35 million tons in 1980. About 20% of the total was shipped to Western countries and 80% was exported to CMEA countries, which are also helping to increase Ukrainian manganese output.

At yearend 1969, reserves of manganese ore in categories $A+B+C_1+C_2$ were estimated at 2,500 million tons, with an average manganese content of 23% to 26.4%. This included 1,020 million tons in the Nikopol' Basin. Reserves of high-grade ore are located in the Chiatura Basin. Furthermore, detailed exploration of the Ushkatyn III manganese deposit in Kazakhstan and preliminary examination of the Porozhin manganese deposit in Krasnoyarsk Kray continued in 1980. A pilot shaft 106 meters deep was sunk at the Bol'shoy Takmak manganese deposit in the Ukraine in 1980.

The principal Soviet manganese basin, the Nikopol' in the Ukraine, has reserves many times greater than the Chiatura, but the ore (average grade 26.4% Mn) is little more than 2 meters thick and is under 80 meters of overburden. Two concerns, the Ordzhonikidze and Marganets, operate in the Nikopol' Basin, containing 19 underground mines, 10 open pits, and 9 concentrators in operation in 1980. More than 75% of the Nikopol' ore comes from open pit operations. Of the concentrated ore, about 48% had a manganese content of over 45%; the balance contained 34%. Construction of the Tavricheskiy manganese complex in Zaporozhye Oblast' began in 1979. Development of an underground mine at this complex, with an annual capacity of 2 million tons of crude ore, also began in 1979. Completion of the development of new mining facilities (400,000 tons per year) at the Chkalov No. 1 open pit was rescheduled from 1979 to 1981.

The Chiatura manganese basin in Georgia, the richest in the U.S.S.R., produced about 2.5 million tons of concentrates in 1980 from 24 underground mines and open pits and 8 concentrators. Over 80% was extracted from underground mines. Of the total amount of beneficiated ore, 66% contained 48.7% Mn and the rest contained 25.6% Mn. A mine with an annual capacity of 300,000 tons of crude manganese ore went into operation in 1980, and two other mines, with the same capacities, were under development in the Chiatura Basin in 1980. Small amounts of manganese ore were produced at the Dzezhdy and Atasuy Mines in Kazakhstan. The Dzezhdy manganese ore-dressing plant, which was put into operation in May 1965, processed low-grade ore for the Nikopol' (Ukraine) and Yermak (Kazakhstan) ferroalloys plants. Kazakhstan's manganese ore is sulfur-free and does not contain other impurities. The small Zhaksykotyr manganese open pit became operational in 1978, and the development of the Tsentral'naya Mine of the Dzhedy Ore Administration continued.

Mercury.—Output of mercury was esti-

ated at 62,000 flasks (76 pounds each) and the U.S.S.R. was apparently self-sufficient in 1980. There are numerous deposits mainly in Central Asia, the Soviet Far East, and the Ukraine. The Khaydarkan complex in the south of Kirgiziya, the largest Soviet mercury operation, had four mines and a recovery plant in operation in 1980. At this complex, mercury is mined by both underground and open pit methods. Sinking of the 850-meter Tsentralnaya shaft of the Ulug-Too Mine at this complex continued in 1980. A new shaft at the Chanvay Mine of the Khaydarkan complex was under development in 1980. It is planned to develop the Novoye mercury-antimony deposit at the Khaydarkan complex. The renovation of metallurgical facilities at the Khaydarkan complex continued in 1980 and is scheduled for completion in 1981. Near the Khaydarkan complex, the Glubokaya Mine became operational in December 1980. In the 1981-85 period another mine, Tsentral'naya, is to be developed there. This will increase ore output and mercury production.

The Nikitovskiy complex in the Ukraine, where over 70% of ore is mined by underground and about 30% by open pit methods, is the second major producer of mercury. Two underground mines (2-bis Novaya and Novozavodskaya) and the Polukupol Novyy open pit were in operation here in 1980. The complex overfulfilled the production quota of mercury in 1980. The small Zarkarpatskiy mercury complex processes ores from the Borkutnoye, Shayanskoye, and other small deposits in Zakarpatskaya Oblast', West Ukraine.

Mercury output in the Magadan Oblast' was higher in 1980 than in 1979. Construction of the new Dzidzikrutskiy (Aznob) mercury-antimony complex in Tadzhik S.S.R. continued during the year. Completion of the first stage of this complex has been rescheduled for 1981 from 1976. The development of small deposits is planned in North Caucasus, at Chukotka in the Magadan Oblast', and in other regions of the U.S.S.R. Exploration for new deposits in Kirgizia, the Soviet Far East, and other regions of the country continued in 1980.

Molybdenum—Output of molybdenum concentrates was estimated at 10,400 tons (metal content), 2% above that of 1979. Reserves of molybdenum in ore (molybdenite, copper-molybdenum, and tungsten-molybdenum ores) in the U.S.S.R. may approach 200,000 tons. About 50% of the production is based on copper-molybdenum ores from Armenia, Kazakhstan, Sorskoye, and Siberia; over 30% is from the tungsten-molybdenum ore of Tyrny-Auz (Kabardin A.S.S.R. in the North Caucasus) and Dzhida (Buryat A.S.S.R.). The remainder comes from molybdenite ore mined in Uzbekistan and Siberia. There are more than 100 known deposits of molybdenum, mainly in the Urals, but most are too small to be mined economically.

The deposits now in exploitation are in eight geographic areas. Armenia occupies first place, but concentrates are shipped out of the Republic for further treatment. The Zangezur copper-molybdenum complex (the former Kadzharan and Kafan complexes) supplied over 25% of Soviet molybdenum in 1980. Open pit mining and high metal content in the ores have made Kadzharan molybdenum concentrate among the cheapest in the U.S.S.R. However, there are shortages of ore reserves at the Kafan and Agarak mining and concentration complexes. It is planned to install a molybdenum converter at the Alaverdy metallurgical complex in Armenia.

The Sorsk molybdenum complex in Krasnoyarsk Kray was the largest producer in 1980. Although the ratio of overburden to the ore at the Sorsk open pit increased by 59.3% during the last 6 years, the complex continued the fulfillment of the concentrate production quota. The Tyrny-Auz tungsten-molybdenum complex, which operates the Molibden underground mine and the Mukulanskiy open pit, was undergoing enlargement in 1980. Output of ore at the Mukulanskiy open pit increased, and the output of ore and overburden amounted to about 1 million tons in 1980. The Chorukhdayransk concentrator processes copper-molybdenum ores from the Chorukhdayransk and South-Yashransk deposits in Tadzhikistan. Output of rolled molybdenum in Uzbekistan increased in 1980. Construction of the Zhireken molybdenum complex in Chita Oblast', the completion of which was originally planned for 1975, lagged behind schedule in 1980.

The first stage of the Erdenet copper-molybdenum mining and concentration complex in Mongolia was completed in 1979. Construction of the second stage of the Erdenet complex continued in 1980. Exploration in the 1960's outlined large ore reserves grading 1% copper and 0.02% molybdenum; the concentrates from this complex are shipped to the U.S.S.R.

Nickel.—With an estimated 174,000 tons

of primary production, 1.1% more than in 1979, Soviet nickel output was second to Canada. During the 1966-75 period, output of nickel increased by 94%. There was a plan to increase metal production by 20% to 30% in 1980 compared with that of 1975. But actually, during the 4-year (1976-79) period, production of nickel increased only by 6%.[92] Cuba produced around 37,000 tons of nickel-in-concentrate in 1980. Cuba refines about 18,000 tons of oxides locally in refineries. The remaining cobalt-nickel sulfide concentrate was sent to the U.S.S.R. and Czechoslovakia. About 19,000 tons of nickel cobalt concentrate from Cuba is smelted in the U.S.S.R. The 1981-85 5-year plan calls for increase production of nickel and cobalt by no less than 30% in 1985 over that of 1980.

Known reserves in the Soviet Union are not likely to exceed 5 million tons of contained nickel metal, about half of which consists of low-grade silicate ores. Over 50% of the total reserves is in cupriferous pentlandites, containing commercially recoverable copper, cobalt, platinum-group metals, and some minor metals. Sulfide ores are mined at Norlisk in Krasnoyarsk Kray (East Siberia) and in the Pechenga-Monchegorsk area in the Kola Peninsula. Oxide ores are produced in the Aktyubinsk area of Southern Urals, the Ufaley area of the Central Urals, and the Ukraine. The centers of production, in order of importance, continue to be Norilsk, the Urals, and the Kola Peninsula. Of the seven smelters in operation, Norilsk is the most important; the Ufaley, Rezh, and Khalilovo smelters in the Urals are a close second; the Monchegorsk and Pechenga smelters are third; and the Pobuzhsk ferronickel plant in the Ukraine is fourth. In the future, the Soviet Union will be an important nickel exporter, based on both Soviet and Cuban concentrates.

The Norilsk complex in East Siberia is producing copper, nickel, cobalt, platinum-group metals, gold, silver selenium, and other rare metals. During the 3-year period prior to 1979, production of refined nickel increased by 10.9% compared with a 20% planned target. Construction of new facilities, which were to increase capacities for production of nickel by 80%, copper by 70%, and cobalt by 16% was planned. Capital stocks of the Norilsk complex are valued at over 3,000 million rubles. Annual expenditures for capital repairs amounted to about 100 million rubles and for current repairs in excess of this amount.

Construction of the 1,000-million ruble Nadezhda metallurgical complex at Norilsk, a major project of the 10th 5-year plan (1976-80), continued with the technical assistance of Finnish companies; its capacity is to be 550,000 tons per year of nickel concentrate (100,000 tons of nickel) and 650,000 tons per year of copper concentrate (200,000 tons of copper). The autoclaves of this facility are the first of their kind in the Soviet Union's nonferrous metallurgy. The first stage was put into operation in October 1979, producing sulfide concentrate and sulfur from sulfur concentrate. Planned production of the first copper and nickel at the Nadezhda plant at Norilsk is scheduled for February 23, 1981. A new nickel electrolysis shop is to be brought into service in 1981. When the Nadezhda complex attains full capacity, it is expected that output of nickel will be doubled. The new facility will be fed by a 33-kilometer slurry line from Talnakh.

The ores at Severonikel production association in the Kola Peninsula are mined by both open pit and underground methods. The Zhdanov mining and concentration complex is the largest in this area. The capital stocks of the Pechenganikel metallurgical complex of the Severonikel production association are valued at $500 million. Four small underground mines (Kaula-Kotselvaara, Eastern, Western, and Northern) and one small open pit (Kaula-Kammiki) were in operation at the Pechenganikel complex in 1980. During the 1976-80 period, the production of ore at the Pechenganikel complex increased by 6.7%, output of matte increased by 7.3%, and production of nickel increased by 11.8%. Completion of additional production facilities at the nickel association in Monchegorsk, the Kola Peninsula, is planned for 1981. Production of nickel is to increase by 50% in the future.

The Port of Murmansk continued handling Norlisk ore for the Severonikel complex. During the 7 to 8 months of the navigation season, 200,000 tons were shipped; this figure is to be increased in the future. Oxide ore is mined at Promezhutochnoye, Novo-Burenov, Oktyabr', and at other deposits. The Shcherbakov oxide ore open pit at the Kimpersay region in the Aktyubinsk area of the south Urals in Kazakhstan was put into operation in 1979.

The U.S.S.R. is financing a $600 million expansion of Cuban nickel production, with

output of 20,000 tons per year scheduled for 1985. It was planned to expand production of the Nicaro plant from 18,000 to 22,500 tons per year by 1980; to expand production of nickel at the Moa plant from 18,000 to 24,000 tons per year by 1980; and to construct two 30,000-ton-per-year nickel-cobalt oxide plants within 8 kilometers of the Moa plant. The first new plant (Punta Gorda) is scheduled for completion by 1983-84 and the target for the second is 1985-86.

Platinum.—The Soviet Union remains the largest producer and exporter of platinum-group metals, supplying 20% to 25% of international exports of platinum and more than 50% of world consumption of palladium and rhodium. The U.S.S.R. is steadily expanding its output of platinum-group metals. The estimated output was 3.25 million ounces in 1980, or about 1.5% over that of 1979. Ore reserves are adequate to maintain production and increased exports for many years. In 1975, it was planned to increase production of platinum-group metals at Norilsk by 60% over 1970 levels. The 5-year plan called for Norilsk output to rise by about 80% in 1980 over that of 1975. But slow construction of the Nadezhda plant will limit Soviet primary production increases to an annual rate of 4% to 5%. Production of platinum and platinum-group metals may reach 3.5 million ounces in 1981.

Production of platinum and platinum-group metals comes principally from the Norilsk copper and nickel complex in Krasnoyarsk Kray, the Severonikel and Pechenganikel complexes ("Nikel" association) on the Kola Peninusla, and several smaller placer deposits in the Urals. Virtually all platinum-group metals were produced as byproducts with over 75% coming from Norilsk. The first stage of the Nadezhda plant at the Norilsk complex was put into operation in 1979. The high priority given to the Norilsk development suggests a determination to proceed with increased production despite high costs imposed by the harsh northern climate. Expansion is expected to accelerate in a few years, with completion of the Oktyabr' underground mine, and the attainment of capacity of the Nadezhda complex. The mine, under development since 1969, was scheduled for completion in six stages by 1980; the first four stages are in operation and development of stages 5 and 6 was rescheduled for the 1981-85 period.

Silver.—Output of silver was estimated at 46 million ounces, the same as that of 1979. Almost all silver is produced as a byproduct from nonferrous operations, although 14 gold treatment plants also produced silver in 1980. The Norilsk complex in Krasnoyarsk Kray and some copper-nickel enterprises in the Kola Peninsula are also producing silver. Production continued to be centered in the Urals, Kazakhstan, the Soviet Far East, East Siberia, and Armenia. Complex ores in the Urals contain 6 to 15 grams per ton of silver. By 1985, the U.S.S.R. should produce around 48 million ounces, compared with an estimated production of 46 million ounces in 1980. In 1980, the Soviet Union imported over 31 tons of silver compared with about 15 tons in both 1978 and 1979.

Both the Matrosovo gold ore mine and the Karamken gold mining and concentration complex of the Severovostokzoloto gold production association in the Soviet Far East did not fulfill the silver mining plans in 1980. The Karamken complex produced less silver than planned. The Dukat gold mining and concentration complex, also in the Soviet Far East, started production in 1980. However, the technology for extraction of this metal was not adjusted at this enterprise and the new equipment was not mastered. There was a shortage of drilling rigs at the open pits and pipes, which were needed for assembly of washing machinery.

Tin.—Although the Soviet tin production policy is based on self-sufficiency at any price, output continues to be inadequate and over 20% of requirements had to be imported in 1980. Primary tin production in 1980 was estimated at 36,000 tons, 3% over that of 1979. The Soviet Far East, Yakutia, and Transbaykal were the main tin producers. Output of tin may reach 38,000 tons by 1985. Most of new production will come from existing or currently developing mines in the Soviet Far East and Central Asia. In 1980, over 25% of total output was from placers of which the Soviet northeast accounted for 75%. The U.S.S.R. is buying tin mostly through London traders. Soviet consumption of tin for use in canmaking and other tin-related industrial products will be slightly increased over the next few years.

Soviet gross tin reserves are estimated at about 600,000 tons of contained metal. Nevertheless, there are shortages of explored reserves at many enterprises. The average

content in ores ranges from 0.6% to 1% Sn. Intensive exploration programs have been carried out and new small deposits have been reported.

The Maritime Kray is the largest producer and the Khrustal'nyy complex, which operates both lode and placer deposits, is the largest enterprise there. This complex operated the Khrustal'nyy, Ege-Khaya, Imeni Lazo, Kholodnyi, and Alyaskavityy mines in 1980. The Ternistyy and Arsen'evaskaya mines of this complex, which were scheduled for completion in 1975, were under development in 1980 and have been rescheduled for completion by 1981. The ore grade is 0.18% to 0.91% Sn at the Arsen'evskaya Mine and 0.87% at the Valkumey Mine in Magadan Oblast'.

The Khingan complex at Birobdizhan, Jewish Autonomous Oblast', Khabarovsk Kray, the largest tin producing enterprise in the U.S.S.R., was to produce more tin concentrate in 1980 following renovation of the concentrator in 1979. Development of the Berezovyy Mine at this complex continued and a new mine was built near the Obluchye. The Solnechnyy complex operated the Solnechnyy, Molodezhnyy, and Pereval'nyy mines. Expansion of the Solnechnyy complex at Khaborovsk Kray, Sherlovgor in the Transbaykal area, and the Deputatskiy complex in the Yakut A.S.S.R. continued in 1980. The Nadezhda Mine of the Solnechnyy complex was opened in May 1980. It was developed on the site of the depleted Pridorozhnyy and Perevalnyy open pits. Prospecting disclosed the lower seams still rich in tin. A foundation was being prepared for a grinding unit at a new shop of the central concentration plant of the Solnechnyy complex. The shop is to be put into operation in 1981. The Solnechnyy complex overfilled the production quotas for the 1976-80 5-year period. Sinking of a 220-meter-deep shaft at the Deputatskiy tin mining and concentration complex in Yakutia began in 1980. Ores from both the Svetlyy and Iultin mines are processed at the Iultin complex in the Magadan Oblast'.

The Tagobikul, Kumarkh, Mushiston, and the Kaznor deposits of Tadzhikistan are producing small quantities of tin. Recovery of tin has been organized by processing of tailings at the Ognevskiy concentration plant of the Belogorsk polymetallic complex in Kazakhstan. Recovery of tin has also been started from processing of lead scrap.

The La Palca plant, near Potosi in Bolivia, is being built with technical and financial assistance from the Soviet Union. The extraction of tin from the slag heaps is planned.

Three known tin refineries were operating in the U.S.S.R. in 1980: Novosibirsk, Ryazan', and Podol'sk (near Moscow). Concentrates from Siberia and the Soviet Far East are shipped to the Novosibirsk plant, which is the principal supplier of tin in the U.S.S.R. It was planned to increase output of metal at the Sherlova Gora, Ege-Khaya, Leningrad, Sinancha, and other smelters. Output of secondary tin in 1980 was estimated at 12,000 tons. Construction of a tin processing unit at the Rustavi secondary nonferrous metals plant in Georgia continued in 1980.

Titanium. —Titanium production in 1980 was estimated at 37,000 tons, about 3% over that of 1979. Production of titanium was programed to be raised 40% in the 1976-80 period, but during the years 1976-79 the actual increase was only 19.6%.[93] The Ust'Kamenogorsk titanium-magnesium complex in Kazakhstan experienced a shortage of raw material during the 1976-80 period. The titanium slags have been transported to this complex from the Ukraine.[94] Soviet reserves of TiO_2 have been estimated at about 10 million tons, from a 70-million-ton ore reserve averaging 10% to 20% TiO_2. The industry continued to be based mainly on Ukrainian and Siberian ilmenite and rutile.

The Soviet Union, which was supplying about 35,000 tons per year of titanium sponge to the world market, curtailed shipments in 1979. As a result, prices jumped from under $10 per kilogram to about $40. Reportedly, the U.S.S.R. imported 44,000 tons of titanium ores (ilmenite, rutile, and zircon) from Australia in 1979.

The most important sources of ilmenite are placer deposits on two right-bank tributaries of the Dnieper River in the Ukraine. Major producers continue to be the Samotkanskoye zirconium-titanium alluvial deposit and the Volchanskoye titanium deposit in Dnepropetrovsk Oblast'; the Irshanskoye, Streminogorskoye, and Zelenogorskoye titanium deposits in Zhitomirskaya Oblast'; and the Tarasovskoye deposit in Kiyevskaya Oblast'.

Two complexes, the Irshanskiy using dredges and the Verkhnednepprovskiy, operate these deposits and are the main raw material suppliers for the Soviet titantium industry. Four stages of the Irshansk con-

centrator were in operation in 1980.

Tungsten.—Production of tungsten in concentrates was estimated at 8,700 tons, the same as that of 1979, with North Caucasus, Kazakhstan, Uzbekistan, Transbaykal, and the Soviet Far East continuing as the principal producers. Production of tungsten was insufficient to satisfy growing domestic needs and about 2% of the concentrate requirements were imported. The following deposits were under exploitation in 1980: Tyrny-Auz (North Caucasus),Dzhida(Buryat A.S.S.R.); Chorukh-Dayron, Lyangar, Yubileynoye, and Ingechka (Central Asia); Akchataus, Karaobin, and Verkhne-Kayraktin (Kazakhstan); Iultin (Magadan Oblast'), Vostok, and Lermontov (Maritime Territory), and Kul'gutin in the Altay region. Most of the deposits in the U.S.S.R. are low grade. The largest deposit is in the North Caucasus, the Tyrny-Auz deposit, contains both molybdenum and tungsten. The largest deposits in Kazakhstan are the Verkhne-Kayraktin tungsten and Akchatau molybdenum-tungsten deposits. There are considerable reserves of tungsten at the Ingechke deposit in Uzbekistan and the Jidda deposit in Siberia. Completion of additional mining facilities at the Akchatau complex was rescheduled for 1981.

The main producer of tungsten concentrates is the Tyrny-Auz tungsten and molybdenum complex, where both underground and surface methods are used. The Nal'chik plant, based on Tyrny-Auz concentrates, continued operations with the expected increase in tungsten metal output. The Iultin complex is the only tungsten mining enterprise in the Magadan Oblast' and extensive improvements are being carried out here. During the 1976-80 period, the Vostok tungsten mining and concentration complex in the Soviet Far East was setup. The Chorukh-Dayronsk deposit in Tadzhikistan is almost completely depleted and has been replaced by the Yubileyonye deposit, which was put into operation recently. The exploration of the Bogutin deposit in South Kazakhstan and the Maykhura deposit in Tadzhikistan was completed.

The second stage of the Maritime Kray complex was under construction and scheduled for completion in 1982. Originally the richest tungsten ores were mined by surface methods, but an underground mine is now under development.

Vanadium.—The Soviet Union, with large vanadium resources, is becoming an important producer and exporter. The principal sources in 1980 continued to be vanadium-rich slag, a coproduct with iron from the titaniferrous magnetites of the Kachkanar open pits in the Urals. The Nizhniy Tagil metallurgical complex and the Chusovskoy metallurgical plant in the Urals are the enterprises that produce raw material for the production of vanadium and its alloys. Nizhniy Tagil, where the vanadium slag is produced from 130-ton oxygen converters, is the only modern enterprise. The vanadium content of the pig iron at Chusovoy is 0.54% and that at Nizhniy Tagil is 0.45%. After devanadization of the pig iron, the average V_2O_5 content of the slag at Chusovoy is 17.2% and that at Nizhniy Tagil is 21.2%.

The enlargement of facilities at the Kachkanar complex expanded output from 33 million tons of crude ore to 40 million tons, but slow construction of the facilities for processing of vanadium at the Nizhniy Tagil metallurgical complex has not made it possible to increase the output of vanadium products considerably. The development of the Kachkanar No. 2 and additional facilities at the Nizhniy Tagil complex is planned to increase production of vanadium in the future. It is also planned to construct special units at some alumina plants for the recovery of vanadium pentoxides as a byproduct from bauxite and other raw materials.

Minor Metals.—The Soviet Union possesses commercial deposits of all the rare metals that have assumed importance in modern rocketry, aircraft,and nuclear energy. However, extraction of many of the deposits remains low. The main deposits are in Kazakhstan, the Kola Peninsula, Uzbekistan, Armenia, the Urals, the Ukraine, Norilsk, Transbaykal, and the Soviet Far East. Known resources of rare metals are sufficient to satisfy the needs of the economy but prospecting still lags behind the potential of the main producing regions of the Soviet Union.

The primary sources of rhenium are molybdenite from copper-molybdenum deposits of Armenia, Kazakhstan, and East Siberia. Byproduct rhenium is recovered at the Balkhash and Dzezkazgan complexes in Kazakhstan, at the Kadzharan coppermolybdenum complex in Armenia, and at the hard-alloy plant in Uzbekistan.

The selenium content in the coppermolybdenum ores of Armenia ranges from 3.6 to 10.5 grams per ton and that of tellurium ranges from 1.5 to 6.2 grams per

ton. Copper concentrates of Armenia contain 46 to 110 grams per ton of selenium and 18 to 62 grams per ton of tellurium. There are 110 grams of selenium and 40 grams of tellurium in the charge of the Alaverdy metallurgical complex in Armenia. During the 1976-80 period, recovery of tellurium from lead dust at the Chimkentskiy lead plant in Kazakhstan increased by 1%.

Byproduct gallium is recovered from raw materials used to produce aluminum at Volkhov (Leningrad Oblast') and Pavlodar (Kazakhstan) aluminum plants and at the Tikhvin (Leningrad Oblast') alumina plant. Production of gallium increased at the Pavlodar aluminum plant in Kazakhstan in 1980. The main centers of indium and thallium extraction continued to be the Ust'-Kamenogorsk lead and zinc complex (Kazakhstan) and the Chelyabinsk zinc plant. The Ust'-Kamenogorsk titanium and magnesium complex in Kazakhstan began recovering scandium. In the 1976-80 period, recovery of thallium at the Chimkent lead plant in Kazakhstan increased by 3.4%. During the 1976-80 period, the output of minor metals at the Ust'-Kamenogorsk lead-zinc complex increased as follows: Indium, 80%; gallium, 95%; and selenium, 70%.

During the 1965-75 decade, the production of rhenium began at the Balkhash and Dzhezkazgan complexes and the Chimkent lead plant in Kazakhstan, production of gallium began at the Pavlodar aluminum plant, and production of vanadium and scandium began at the Ust'-Kamenogorsk titanium and magnesium complex. Facilities at the Chimkent lead plant for the production of thallium, cadmium, tellurium, germanium, and other minor metals from slag have been put into operation. At the Ognevsk and Belogosk concentration plants of the Belogorsk complex in Kazakhstan, facilities for the production of tantalum from tailings were put into operation in 1980. The Kirgiz metallurgical complex in Kirgiziya produces rare-earth elements.

Among enterprises exploiting zircon alluvial deposits in 1980 were the Samotkan deposit in Dneprovsk Oblast' in the Ukraine. The Verkhnedneprovskiy complex, brought into operation in 1969, increased output of zircon concentrate in 1980. The Mekhanobr Institute in Leningrad has developed technology for recovery of baddeleyite (ZrO_2) from magnetite iron ore of the Kovdor deposit at the Kola Peninsula.

NONMETALS

The Soviet Union produces a wide variety of nonmetallic minerals. However, the resources position varies from adequacy for many nonmetallic minerals to an apparent shortage of others such as barite, fluorspar, mica, and talc.

Asbestos.—The Soviet asbestos industry remains the largest in the world, with an estimated output of the seven grades at 2.15 million tons, or 130,000 tons more than in 1979. Over 59% of the total production came from the Uralasbest complex, about 30% from Dzhetygara in Kazakhstan, over 5% from the Tuvaasbest complex in Tuva A.S.S.R., and 6% from the Kiembay complex in Orenburg Oblast'. Exports rose from 385,000 tons in 1970 to 613,303 tons in 1,975 and to an estimated 500,000 tons in 1980, with about one-third going to Western markets. Despite the asbestos export expansion in recent years, the domestic deficit was expected to be about 100,000 tons in 1980.

Development in the asbestos industry has been concentrated in the Urals, Kazakhstan, Tuva A.S.S.R., and Orenburg Oblast'. Total output of the seven grades of asbestos at the Uralsasbest complex was estimated at 1.27 million tons. Reported production was 1,256,000 tons in 1979 and 1,240,000 tons in 1978.[95] Three open pits at this complex produced 41 million tons of crude ore and dumped 103 million tons of overburden in 1980. It is estimated that mining of crude ore and overburden will be increased from 144 million tons in 1980 to about 150 million tons in 1981, but production of marketable asbestos is expected to remain unchanged at about 1.27 million tons because of reduced grades. It is planned to construct the No. 7 concentrator at Uralasbest with an annual capacity of 340,000 tons of asbestos.

In Kazakhstan, a large complex has been developed for the Dzhetygara deposit in Kustanay Oblast', the second largest in the Soviet Union. The first mill (annual capacity 200,000 tons) was commissioned in 1965. During the 1971-75 period this mill was renovated and production increased from 259,000 tons in 1970 to an estimated 350,000 tons in 1980. The Dzetygara No. 2 mill (annual capacity 400,000 tons) was completed in 1975 and produced an estimated 290,000 tons in 1980. Total output at the Dzhetygara complex was estimated at 640,000 tons in 1980.

The first mill of the Tuvaasbest complex (commissioned in 1964) produced 50,000 tons in 1980. A second mill was commissioned in April 1976. Total output at this complex was estimated at 110,000 tons in 1980.

Construction of the Kiembay asbestos complex in Orenburg Oblast' (Southern Urals) was started in 1968 and continued in 1980. Seven CMEA members are assisting with this project. It calls for a total contribution of 106.2 million transferable rubles from the six East European member countries. The total cost of the project is 300 million rubles.

The design capacity of the Kiembay project is 500,000 tons per year of grades III through VI from 24 million tons of ore with an average grade of 4.4%. The first 250,000-ton stage was completed in November 1979, and 130,000 tons were produced in 1980. The output will be shared among the CMEA members in proportion to their contribution. Equipment was supplied by Bulgaria, Hungary, the GDR, Poland, and Romania; Czechoslovakia shipped machinery for ore transport. From 1981, 170,000 tons of asbestos will be supplied annually to the participating countries for 12 years and afterwards they will be able to extend the agreement for another 10 years. The second stage of the Kiembay complex was put into operation in December 1980. It is to produce 250,000 tons of asbestos per year, raising the complex's total capacity to 500,000 tons per year.

Barite.—Barite is mined by both open pit and underground methods at many operations; crude output is concentrated by flotation. Estimated domestic production in 1980 totaled 500,000 tons. In 1980, about 50% of the country's barite consumption was produced domestically; the balance was imported, mainly from North Korea, Yugoslavia, and Bulgaria. The main centers of production continue to be Georgia, West Siberia, and Kazakhstan. Construction of a 45,000-ton-per-year complex in Khaishi in Svanetia, Georgia, and the development of the underground mine at the Zharemsk polymetallic complex in Kazakhstan continued in 1980. Production of barite from old tailings of the Maykansk, Kayraktinsk, and Kentaussk concentration plants in Kazakhstan started in 1980.

Diamonds.—The U.S.S.R. continues to make progress in expanding its diamond industry, which is centered in Yakutia, where about 20 deposits have been discovered. In 1980, output was estimated very roughly at 8.6 million carats of industrial quality and 2.25 million carats of gem quality. Next to fossil fuels and precious metal exports, diamonds account for a large share of the Soviet Union's overall foreign earnings.

Production in Yakut A.S.S.R. started at a small plant in 1957. In January 1980, the industry consisted of the Mirnyy open pit with five concentrators, the Aykhal open pit and concentrator, the Udachnaya placer mine and concentrator, and the Irelyakh placer mine with two dredges. Small quantities of gem and industrial stones are produced from the Vishera River region in Perm Oblast' (Western Urals) where four dredges and two separation plants were operated at two deposits in 1980. The enlargement of the Udachnyy complex was completed, and the second stage of the concentrator was put into operation in August 1978.

A substantial but unkown quantity of synthetic diamond was produced in 1980 by plants in Kiyev, Yerevan, Moscow, Tashkent, and Poltava.

Gem stones are cut at Leningrad, Sverdlovsk, and Smolensk. Sales of cut stones are rising steadily, and substantial increases were expected by 1980. The U.S.S.R. has arranged to market part of its diamond output in Antwerp through a newly formed Soviet-Belgian company in which the Soviet export organization Almazyuvelirexport has the controlling interest.

Mineral Fertilizers.—Estimated production totaled 24.6 million tons in nutrient content or a reported 104 million tons (original planned quotas 143 million tons and revised quotas of 115.3 million tons) in bulk fertilizer content, an increase of 10% over that of 1979. In 1980, plant capacities were to be expanded by about 11 million tons per year of fertilizers (Soviet standard). The Soviet fertilizer industry is beset by serious problems and did not meet even its revised targets for production of fertilizers or for the construction of additional facilities. Fertilizer production was 39 million tons (Soviet standard) below the original planned target and 11.3 million tons below the revised goal for 1980.

It is estimated that nitrogen fertilizers constitute around 42%, potassium fertilizers about 34%, phosphate fertilizers 21%, and phosphate flour 3% of total fertilizer output. In 1985, the Soviet mineral industry plans to produce 150 million to 155 million tons (Soviet standard) of fertilizers, or 36

million to 37 million tons of nutrient content. The mineral fertilizer industry was favored in terms of the import of Western machinery and equipment. Ammonia production was also to benefit from imported technology. About 26 large Western-supplied ammonia plants were planned to be commissioned in 1976-80, representing 11.4 million tons of the 13.5 million tons in planned additional capacity. The results achieved by 1980, however, do not appear to justify the goals set in 1976.

There was an increase in exports of mineral fertilizers. Despite substantial production and large exports, fertilizers did not meet domestic demand.

During the 1976-80 period, equipment for 26 ammonia plants, each with a capacity of 450,000 tons, was to be supplied by Western companies. They were to be constructed with the assistance of Toyo and Mitsui Engineering (18 plants), Chemico (4 plants), and Cruesot-Loire (4 plants). Two ammonia plants near Odessa (Odessa Nos. 1 and 2) have been built on a compensation basis under an agreement with Occidental, calling for the supply of urea to the United States in exchange for superphosphate acid. Under an agreement signed in July 1980, Vietnam was granted a large credit to build a fertilizer plant with Soviet assistance.

The average content (nitrogen, phosphorous, and potash) is expressed in Soviet standard units. Nitrogen is expressed as ammonia sulfate, 20.5% N, phosphate is expressed as 18.7% P_2O_5, potash is expressed as 41.6% K_2O, and ground rock phosphate (phosphatic flour) is expressed as 19% P_2O_5.

Phosphate.—Estimated output of phosphate rock totaled 64 million tons in 1980, including 45 million tons of apatite ore (16.4% P_2O_5) and 19 million tons of sedimentary rock (13% P_2O_5). The main production centers continued to be the Apatit Association on the Kola Peninsula and phosphorite deposits at Karatau in Kazakhstan. The Chilisay phosphorite basin in Aktyubinsk Oblast', Kazakhstan, which is under development, will be the third main center of phosphorite production. Deposits of phosphorites also occur in Upper Kama in the Urals, Egor'evsk, and Lopatino in Moscow Oblast', Kingisepp in Leningrad Oblast' and some other regions, but the grade is rather low. Generally they produce phosphorite flour with about 19% P_2O_5. The apatite concentrate provided over 80% of all raw materials for the production of phosphate fertilizers. Over a number of years the Soviet Union has been progressively reducing its exports of apatite concentrate to Western Europe. In 1980, these exports decreased to an estimated 200,000 tons compared with 300,000 tons in 1978. During the 1981-85 period, the output of Soviet mineral fertilizers is to increase by 50% and be brought up to no less than 150 million tons (Soviet standard) in 1985. The most rapid rate of growth is to be in the production of phosphorous fertilizers. It is planned to increase output of apatite concentrate in the Kola Peninsula and to expand the production of phosphate rock in Kazakhstan.

There are 45 commercial deposits at the Karatau phosphate basin in Kazakhstan. The five largest contain more than half of the total reserves of Karatau. Seven open pits at the Aksay and Zhantas deposits and the Molodezhnyy underground mine at the Chulaktau deposit produced an estimated total of 9.5 million tons in 1980. Surface mining of the Aksay deposit terminated and shaft sinking began in 1978 and continued in 1980. Also, the development of the Tyesay deposit for surface mining continued in 1980. During the 1976-80 period, output of phosphate rock in Kazakhstan increased by 110%, but planned production targets for each of these years were not met. The 1981-85 5-year plan calls for an increase in production of phosphate rock at the Karatau phosphate basin in Kazakhstan in 1985 by 50% over that of 1980.

The development of the Chilisay open pit in the Aktyubinsk Oblast', Kazakhstan, began in 1978 and continued in 1980. Output of 5.9 million tons of ore and the production of 1.77 million tons of phosphorite flour from this deposit was planned for 1980. Construction of the Chilisay complex continued in 1980. The Voskresensk complex in Moscow Oblast' produced over 2 million tons of phosphate flour the same year and the production of ground phosphate rock at the Verkhnekamsk phosphorite area reached about 0.6 million tons in 1980 instead of the planned 0.7 million tons.

The phosphate reserves in place at the Karatau Basin in categories $A+B+C_1$ were estimated in 1978 at about 1,500 million tons and 500 million tons in category C_2 (overall average grade 21% to 26% P_2O_5). The reserves in place at the Chilisay phosphorite basin in category $A+B+C_1$ were estimated at over 1,000 million tons and about 800 million tons in category C_2. Re-

portedly, the third largest phosphorite deposit in the Soviet Union has been discovered in Rakvere, Estonia.

Potassium.—The Soviet Union is one of the world's leading countries in potassium ore reserves, fertilizer output, and exports of potash salts. Estimated output in 1980 was 19.3 million tons (41.6% K_2O) or 8 million tons in nutrient content, about 20% over that of 1979. Under the original 1976-80 plan, output of potash was to increase 35% from 19.1 million tons (41.6% K_2O), or 7.9 million tons in nutrient content in 1975 to 26 million tons (41.6% K_2O), or 10.8 million tons in nutrient content in 1980. It was planned to complete construction of Soligorsk No. 4, Berezniki No. 4, and Novosolikamsk by 1980. It was also planned to enlarge Solikamsk No. 1 and Soligorsk No. 3 by 0.2 million tons per year each and to enlarge No. 3 Berezniki by 0.14 million tons per year during the 1977-80 period. The revised plan called for 22.4 million tons (41.6% K_2O) of potash production in 1980.

The total output of the potassium mines in the U.S.S.R. exceeded 64 million tons of ore in 1980 but was to be increased to 85 to 90 million tons, according to the original 5-year plan target. The level of potassium production rose at the Beloruskaliy Concern but the Uralkaliy Concern was experiencing problems. In 1979, the Uralkaliy Concern produced over 1.5 million tons of potassium less than in 1978. There were 12 underground potassium mines and 1 open pit in operation in the U.S.S.R. in 1980. The depth of underground mining is 400 to 800 meters. The Kalush Mine in the Western Ukraine, which has been under exploitation for more than 100 years, will be depleted in the near future. It was planned to produce potassium fertilizers with 52.4% K_2O in 1980 compared with 49.4% in 1975. The Soviet standard measurement unit is 41.6% K_2O. The U.S.S.R.'s major market for potash remains in the centrally planned countries of East Europe.

Gross potash reserves are reported at 22,900 million tons of 16% to 40% K_2O content (3,800 million tons of K_2O). About two-thirds of the reserves are located at the Upper-Kama Basin in the North Urals. Reserves are principally carnallite and sylvite with 13% K_2O equivalents. The second largest reserve region (4,600 million tons) is Starobinsk (Soligorsk) in Belorussia, which contains sylvite (16% to 20% K_2O). The third important basin is the Livov Oblast' (2,900 million tons) in the Western Ukraine. The reserves of potassium ores in the Karlyuksk deposit in Turkmen S.S.R. were reported in 1975 at 2,000 million tons and those of the Tuva-Gutansk deposit were reported at 400 million tons. The first discovery of potassium salt in the Western U.S.S.R., was recently made at Ladushkin in Kaliningrad Oblast'.

There are four potash-producing centers: Solikamsk and Berezniki on the western side of the Central Urals, Soligorsk in Belorussia, and Stebnikov and Kalush in the Western Ukraine. The following 11 complexes, with a total annual capacity of 23.08 million tons (41.6% K_2O), were in operation in 1980: Berezniki Nos. 1, 2, and 3; Solikamsk Nos. 1 and 2; Soligorsk Nos. 1, 2, and 3; and the first stage of Soligorsk No. 4; and the first stages of the Novostebnikov and Kalush complexes. In 1980, three complexes were under construction: The third stage of the Soligorsk No. 4 in Belorussia, Berezniki No. 4, and Novosolikamsk in the Urals.

Fluorspar.—Despite the Soviet Union's effort to achieve self-sufficiency, it remained a net importer of fluorspar. Imports of fluorspar, mainly from Mongolia, mainland China, and Thailand, increased from 144,700 tons in 1975 to 493,000 tons in 1979 to an estimated 550,000 in 1980. With an estimated production of 520,000 tons, Soviet consumption of fluorspar in 1980 was over 1 million tons. The iron and steel industry consumed more than 85% of the total and consumption is increasing by 8,000 to 10,000 tons each year.

The Maritime Territory (Yaroslavsk deposit), Transbaykal (Kalunguysk, Abagatuysk, Usuglinsk), Uzbekistan, and Kazakhstan, were the main production areas in 1980. Small quantities of fluorspar are also produced in Tadzhikistan and other regions of the country. The mined ore contained from 20% to 45% CaF_2. The central concentrator in Uzbekistan is treating ores with 24.3% to 26.5% CaF_2 content, and, in the Maritime Territory, a mill is treating ore with an average of 40.5% CaF_2 content.

Mica.—Output, estimated at 46,000 tons, was inadequate to meet demand and strategic-grade mica continues to be imported from India for special industrial requirements. Imports of high-grade mica rose from 160 tons in 1968 to an estimated 680 tons in 1979, and 850 tons in 1980. The following four mining and beneficiation complexes were in operation in 1980: Mamslyuda (Irkutsk Oblast'), Karelslyuda

(Karelia), Kovdorslyuda (Murmansk Oblast' on the Kola Peninsula), and Aldansyluda (Yakutia). Mica is mined mostly by an underground method.

Irkutsk Oblast' continued to be the main supplier of muscovite mica; 75% of all muscovite deposits in the country are in the Mamsko-Chuysk County of the Irkutsk Oblast' where nine small underground mines were in operation in 1980.

The Kovdorslyuda (Kovdor mica) complex in Murmansk Oblast' operates the Yena, Pikolatva, and Kovdor underground mines and vermiculite open pit. Mining of vermiculite began here in 1960 and the capacity of the concentrator is 56,000 tons per year of concentrate. The Karelslyuda (Karel mica) complex in Karelia operates the Plotina, Malinovaya Varakka, and Tedino underground mines. Two 400-meter-deep exploratory shafts were sunk at the Malinovaya Varakka Mine in 1979. It is planned to develop the Slyudyanoy Bor deposit in Karelia in the future.

Salt.—The Soviet Union is one of the world's leading countries for salt reserves, production, and exports. Production in 1980 was estimated at 14.5 million tons. It was originally planned to increase salt production from 12.4 million tons in 1970 to 14 million tons in 1975, and to 20 million tons in 1980. However, the revised production level for 1980 was 14.7 million tons. Exports increased from 293,600 tons in 1970 to an estimated 400,000 tons in 1980. Salt development is concentrated in the Donets Basin (40% of output), the Urals, East Siberia, Armenia, and West Ukraine. The Artemsol' (Artem Salt) concern in the Donets Basin, which operates five underground mines, is the main Soviet supplier of salt. Because of mining mistakes and shortage of freight cars, production at this concern is limited to only 8,000 to 10,000 tons per day instead of the 14,000- to 15,000-ton design capacity.[96] More or less the same situation exists at the Aralsol' (Aralsk Salt), Pavlodarsol' (Pavlodar Salt) concerns, Iletsk Mine, and other salt-producing enterprises.[97] Over one-third of total Soviet salt production is coming from Lake Baskunchak.

Sulfur.—Estimated domestic production in terms of sulfur content totaled 10.9 million tons, of which 3.55 million tons was recovered from pyrite, 3.7 million tons from native sulfur, and 3.65 million tons from other elemental sulfur. Sulfur exports, mainly to CMEA countries, decreased from 463,800 tons in 1970 to an estimated 430,000 tons in 1980. Imports of sulfur increased from 216,700 tons in 1970 to an estimated 600,000 tons in 1980. The principal producers of native sulfur continue to be Rozdol (West Ukraine), Gaurdak in Turkmen S.S.R., Yavorov in West Ukraine, and the Volga Group of the Kuybushev sulfur complex, which together produced the bulk of the country's requirements. Production doubled during the past decade as a result of growth both in the elemental sulfur and as byproduct output. Frasch and the Orenburg sour-gas sulfur projects have become important in the last few years and it is expected that these sources will account for most future growth in the Soviet sulfur industry. The U.S.S.R. is currently ranked fourth in the world in terms of brimstone production.

Over 1 million tons of sulfur was recovered from sour gas in 1980. Production of sulfuric acid increased from 22.4 million tons in 1979 to an estimated 23 million tons in 1980.

Talc.—The U.S.S.R. produced 490,000 tons of talc in 1980, 2.1% over that of 1979. Only the Onotsk deposit in the Irkutsk Oblast', with an annual capacity of 45,000 tons, produced high-grade iron-free material. Despite large reserves and the development of new mines, imports of talc from North Korea and Bulgaria increased from 90,900 tons in 1975 to an estimated 120,000 tons in 1980.

The Kirgiteysk deposit in Krasnoyarsk Kray was the major producer of lower quality talc. The Miass and Shabrovsk deposits in the Urals ranked second in output. Some talc is mined from the Tertiy-Mindorskoye and Kvachevskoye deposits in South Osetinsk, Georgia. The raw material at the Onotsk deposit is shipped for processing to the Miass talc mill in the Urals. The Medvedevskoy talc deposit in Chelyabinsk Oblast' was under development in 1980.

MINERAL FUELS

Production of primary energy derived from fossil fuels, fuelwood, and hydroelectric and nuclear generation increased from 1,881 million tons (standard coal equivalent) in 1979 to an estimated 1,936 million tons in 1980. Compared with the 1975 output, the 1980 production of oil rose 23% (planned 30%), natural gas 50% (planned 55%), coal 2% (planned 15%), hydroelectric power 41% (planned 47.9%), and nuclear power 250% (planned 333%). The share of petroleum and natural gas in total Soviet primary

energy production increased from 70.3% in 1979 to 72.9% in 1980, while that of coal (anthracite, bituminous, and lignite) declined from 25.7% to 25%.

Total consumption of all types of primary energy in the Soviet Union increased from 1,594 million tons in 1979 to an estimated 1,638 million tons in 1980. The share of petroleum and natural gas in the total Soviet primary energy consumption increased from 66.2% in 1979 to 67% in 1980, while that of coal declined from 29.1% to 28.2%. Clearly, there will be a trend towards greater use of oil in the future. However, it is expected that the U.S.S.R. will make great efforts to substitute coal and natural gas for petroleum to make the latter available for export.

In 1980, the U.S.S.R. produced 603 million tons of crude oil and gas condensate, 716 million tons of run-of-mine coal and lignite, and 435 billion cubic meters of natural gas. Soviet long-range forecasting places the demand for raw coal and lignite at over 800 million tons in 1985 and 1,000 million tons by 2000.

Estimated total primary energy balance of the U.S.S.R. for 1980 is shown in table 14.

Table 14.—U.S.S.R.: Estimated total primary energy balance, 1980

(Million tons of standard coal equivalent)

	Production	Imports	Exports	Apparent consumption
Total primary energy	1,936	24	322	1,638
Coal (lignite, anthracite, bituminous, coke)	482	10	30	462
Crude oil and petroleum products	860	12	240	632
Natural and associated gas	515	2	50	467
Peat	14	--	--	14
Oil shale	12	--	--	12
Hydropower	22	--	2	20
Nuclear power	7	--	--	7
Fuelwood	24	--	--	24

Coal.—In 1980, the Soviet Union produced an estimated 716 million tons (originally planned 800 million tons, revised goal 745 million tons) of run-of-mine coal as follows: Bituminous, 473 million tons; anthracite, 70 million tons; and lignite, 164 million tons. Estimated according to Western practice, this was equivalent to 411 million tons of "clean coal," placing the U.S.S.R. second among the world's coal producers. Over 33% of the total output was surface mined. Production of run-of-mine coal and lignite in 1980 was 2.7 million tons below that of 1979.

Production of raw coal and lignite in 1980 from the Donets Basin amounted to 31%; Kuznetsk, 19%; Karagnada, 7%; Moscow, 4%; Kansk-Achinsk, 4%; and other areas, 31%. There were about 800 underground mines with an average annual capacity of 600,000 tons of raw coal and 70 open pits with an average annual output of 3.4 million tons of run-of-mine coal and lignite. The annual capacity of coal and lignite mines increased by 15 million tons (raw coal and lignite) in 1980. In 1985, the planned production of raw coal and lignite is to reach 770 million to 800 million tons.

Preparation of coal for the market does not play a great role in the industry and is normally restricted to coking coals and coal for export. The shortage of coal beneficiation facilities forced Soviet planners to place greater emphasis on improvement in quantity as an expedient.

Practically all Soviet coal requires beneficiation, but of the 716 million tons produced in 1979, only an estimated 345 million tons were treated to produce an estimated 182 million tons of clean coal. About 66 preparation plants are treating coking coal, 38 plants are processing anthracite, and 50 preparation plants are treating coal and lignite for powerplants.

The official average ash content of coal shipped to consumers in 1980 was about 20.3%. The average calorific value of coal from the Karaganda, Kuznetsk, and Donets basins fell by 600, 900,and 1,200 kilocalories, respectively, during the last decade. Up to 40 million tons of substandard quality coals and lignite are being delivered to thermal powerplants annually or about 20% of the total requirements of these plants.

Total Soviet economically minable coal and lignite reserves in place in categories $A+B+C_1$ in Janaury 1975 were 420,000 million tons, including 87,000 million tons of coking coal and 190,000 million tons of lignite. Over 70% of the total coal and lignite reserves are located in the eastern (Asian) part of the U.S.S.R.

Natural Gas.—The country produced 435 billion cubic meters of (originally planned

400 billion cubic meters, revised goal 435 billion cubic meters) usable gas, 7% more than in 1979. In 1985, the output of natural gas is expected to reach 600 billion cubic meters. According to Soviet data, gas reserves in place in the $A+B+C_1$ categories as of January 1978 were 29,000 billion cubic meters, of which 15% of the total were in the European part of the U.S.S.R., 72% were located in Siberia and the Soviet Far East, and 13% were in Central Asia and Kazakhstan.

Petroleum.—Crude oil and gas condensate output in 1980 increased by 17.4 million tons (2.5%) to 603 million tons (610 million tons planned). In 1980, over 500 oil and gas condensate fields (including 36 large fields) were in operation with a total of over 80,000 wells. Soviet petroleum policy is based on the principle of maximum production at any price. The production of crude oil and gas condensate in 1985 is planned at 620 to 645 million tons.

The Soviet Union is rich in oil. However, despite the new discoveries, the growth rate of reserves is lagging behind the rate of growth in extraction. According to Soviet sources, crude oil reserves in place in the $A+B+C_1$ categories as of January 1979 were 12,900 million tons. A 30% to 40% recovery of crude oil in place was claimed in 1980. For the seventh year, the U.S.S.R. remained the world's largest oil producer. The country continues to export crude oil and petroleum products even though the quantities available for internal consumption have been inadequate. The Soviet Union became a net exporter of crude oil in 1951 and of petroleum products in 1954 and has gradually strengthened its position since that time. The U.S.S.R. exported over 25% of its production in 1980.

The U.S.S.R. is the world's largest oil producer and it is the second biggest oil exporter (after Saudi Arabia). But the planned target for recovery of crude oil and gas condensate was not met in 1980. Production costs per ton of crude increased in the Soviet Union by 20% for the last 3 years. Cost of drilling wells increased by 6% to 7% each year. Transport distance for crude oil have trebled during the last 15 years. Investments in the oil industry in the years 1976-80 were 50% larger than in the preceding 5 years, and more than doubled what they were in 1966-70. Cost increased much more rapidly than production.

The Soviet Union is experiencing production problems, and some Western experts predict that the U.S.S.R. will be a big net importer of oil by 1985. A 1977 study by the Central Intelligence Agency (CIA) showed that by the mid-1980's the U.S.S.R. and the East European CMEA countries would be net importers of 175 million to 255 million tons per year. In 1980, the CIA reaffirmed its "conservative" estimate that under the best conditions the Soviet Union will shift from the position of large net exporter to that of a large net importer of oil by 1985. According to the CIA, Soviet oil output may peak at around 595 million tons in 1980 and then decline to 450 million tons in 1985. The agency predicted that the Soviet Union will probably have to import 150 million tons of crude in 1985. The actual increase in production at 14.1 million tons in 1979 and 17.4 million tons in 1980 and the planned increase of Soviet oil production in the 1981-85 years contradict recent CIA projections.

In 1980, the U.S.S.R. produced 603 million tons of crude oil and gas condensate, 112 million tons more than in 1975. However, the figures hide serious financial problems, which in the Soviet economy are not so important as they are in the free economies of Western countries. Soviet oil and gas condensate production slowed toward the end of the 1976-80 period and rose to only 603 million tons compared with the original planned quota of 620 million to 640 million tons and the reduced quota of 606 million tons in 1980. During the 1976-80 5-year plan period, the annual increase in crude and condensate production, in million tons, was as follows: 1976, 28.9; 1977, 26.1; 1978, 25.7; 1979, 14.1; and 1980, 17.4. All of the Soviet net oil output gain is coming from Western Siberia. Production in this region has more than doubled since 1975. Gains outside Western Siberia came from several smaller producing regions in the U.S.S.R. Tataria, Azerbaydzhan, and some other older regions are showing production rate decreases that exceed Soviet predictions.

To replace the declining oilfields in the Ural-Volga area and in the Caucasus, the Soviets had hoped for quick development of West Siberian fields. More than 1,200 million tons of oil have been extracted over 5 years in the Tyumen' Oblast'. But due to shortages of labor and supply, progress there has been slower than anticipated in the original 1976-80 5-year plan. The shortage of labor and the low-quality and shortage of drilling equipment, as well as lack of spare parts are the main obstacles for the development of oilfields in extremely cold

conditions. Living conditions in the Siberian oilfields are bad. The shortage of housing in Western Siberia is most acute. Almost 70% of workers have no apartments of their own, and are living instead in dormitories or in trailers. Labor turnover is topping the 26% mark.

The big oil of Siberia is obtained with a great deal of difficulty. The oilfields being worked have complex climatic conditions and are far from production bases or industrial centers. "Flying teams" of drillers and oil workers from Tataria and Bashkiria, Belorussia, the Ukraine, Saratov, and Baku, work for half a month and than go home for 2 weeks. "Labor"[98] gives a figure of 11,000 for these commuters; the productivity of these teams suffers because people have to change climatic zones twice a month and pass through a period of adaptation.

In the 11th 5-year plan (1981-85) period, it is intended to bring into operation a large number of wells and new fields and to sharply increase drilling operations in Siberia. It is planned to drill annually no less than 9 million meters of wells in Tyumen' Oblast'. On April 14, 1980, a conference was held in the Central Committee of the CPSU to discuss stepping up of capital construction in the vitally important oil- and gas-producing area of Western Siberia. The U.S.S.R. has initiated a program for the intensified development of West Siberian oilfields and gasfields. Thousands of workers are to be drawn from many Soviet regions to build housing, roads, schools, and hospitals. It is planned to increase housing construction by 300% in 1983 compared with the 1980 level.

Oil production in the Soviet Union is expected to reach 620 million to 640 million tons in 1985. The U.S.S.R. plans to step-up the rate of exploratory drilling for oil in Siberia, and will be calling on its CMEA partners to assist in this expansion of oil exploration activity. This expansion will be hampered by shortages of geophysical instruments and modern drilling equipment, although the Soviet deep-drilling technology is improving. The volume of capital construction, drilling, and freight haulage is to be increased by 2 to 2.5 times the level during the 1981-85 5-year plan period.

In 1980, Siberia produced 312.6 million tons of oil and condensate. Production in Siberia is planned to reach 385 million to 395 million tons in 1985 with a possible rise of up to 500 million tons in 1990. The Soviet plan calls for the expansion of oil production up to 2000. The oil production increase is to come from both Western and Eastern Siberia and Yakutia. In 10 to 15 years, oil production in Western Siberia is to be stabilized and the amount of drilling and other related work is to decrease.

The transfer of oil extraction to remote areas of difficult accessibility considerably complicates the work and makes it more expensive. Therefore, the increase will not be big. Soviet oil production by itself is not in trouble, but because of shortages of labor, equipment, and spare parts, the whole Soviet economy is in a difficult situation. Due to the priority in extraction and transportation of natural gas, the increase in the production of crude oil and gas condensate will be much less in the 1981-85 period compared with that of 1976-80.

Oil has long been a major export earner for the U.S.S.R. and it is intended to become more important. In recent years, there has been a growing emphasis on Soviet coal and natural gas production, making more gas available for export. In terms of value, the exports of petroleum rose from 24.6% of total Soviet official exports in 1975 to 27.9% in 1976, 28.1% in 1978 to 34.2% in 1979, and to an estimated 35% in 1980. Despite rising Soviet domestic consumption of oil, deliveries to centrally planned economy countries should continue according to obligations entered into, and deliveries to the West should stay at the same level or decrease only slightly.

Soviet oil exports to CMEA member nations between 1975 and 1980 were nearly 400 million tons. During the 1981-85 period, the U.S.S.R.'s oil deliveries to CMEA countries are to be on the same level as in 1980 (about 80 million tons), despite the more difficult conditions for its extraction. Oil deliveries for the 5-year period are to be brought up to nearly 400 million tons.

The Soviet Union cutback on its oil exports to the Western developed countries in 1980; oil exports to the FRG declined by about 15% from 9.4 million tons in 1979; British purchases of Soviet oil fell sharply from 2.9 million tons purchased in 1979, and Italian imports declined from 6.4 million tons in 1979 to 3.2 million in 1980. France purchased 6.25 million tons in 1980, as in 1979, and Yugoslavia bought 4.5 million tons of Soviet oil compared with 5 million tons in 1979. Annual deliveries of petroleum to India are to amount to 4.75 million tons over the next 5 years compared with deliveries of 3.4 million tons of crude and prod-

ucts in 1980. The agreement with Finland, which was signed in November 1980, calls for annual deliveries of more than 10 million tons per year of crude and petroleum products during the 10-year period, slightly higher than in 1980.

The Soviet Union has been exporting around one-quarter of its oil production in recent years, which helped buildup its hard currency reserves for imports of Western technology and partially for grain.

Exports of petroleum to Western countries may fall at some point, because the periodic increases in world prices make it possible for the U.S.S.R. to earn the same amount of hard currency while exporting less. Natural gas will partially replace oil shipments to Western countries, which provide needed hard currency.

The U.S.S.R. will not be forced to become a net importer of petroleum this decade. The conclusion of some experts that in the middle of the eighties the Soviet Union will turn from a large exporter to a large importer of petroleum, does not correspond with facts. At current world oil prices, the Soviet Union can afford to push even further the development of Siberian oilfields and import the foreign technology. The increase in oil production will be slower in the future, but the periodic increases in world prices makes it possible for the Soviet Union to earn the same amount of foreign exchange while exporting less.

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[1]This publication is based on a review of the sources published by the U.S.S.R.

[2]Supervisory physical scientist, Branch of Foreign Data.

[3]CMEA—Council for Mutual Economic Assistance—was founded in January 1949. The founder members were Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and the U.S.S.R. Albania joined in February 1949 but ceased to take part in meetings in 1961. The GDR was admitted in 1950, Mongolia in 1962, Cuba in 1972, and Vietnam in 1978. Yugoslavia obtained permanent observer status in 1965.

[4]Metallurg (Metallurgist), Moscow. No. 7, July 1974, p. 1.

[5]Tsvetnye metally (Nonferrous Metals), Moscow. No. 3, March 1980, p. 6.

[6]Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 34, August 1976, p. 13.

[7]Trud (Labor), Moscow. No. 7, July 1974, p. 1.

Planovoye khozyaystvo (Planned Economy), Moscow. No. 1, January 1974, p. 32.

Ekonomika neftyanoy promyshlennosti (Economics of Petroleum Industry), Moscow. No. 7, July 1975, p. 3.

[8]Third work cited in footnote 7.

[9]Official exchange rate (February 1981) was 1 ruble=US$1.53. Approximate buying power of 1 ruble relative to prices in the United States for hard goods and food ranges from about US$0.20 to US$0.50.

[10]Trud (Labor), Moscow. Sept. 21, 1980.

[11]Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 34, August 1980.

[12]Voprosy ekonomiki (Problems of Economics), Moscow. No. 8, August 1978, p. 42.

[13]Sotsialisticheskaya industriya (Socialist Industry), Moscow. June 5, 1979.

Tsvetnye metally (Nonferrous Metals), Moscow. No. 10, October 1980, pp. 5-11.

Kazakhstanskaya pravda, Alma-Ata. July 20, 1980, p. 2.

[14]Trud (Labor), Moscow. Oct. 6, 1979, p. 2.

[15]Work cited in footnote 14.

[16]Planovoye khozyaystvo (Planned Economy), Moscow. No. 9, September 1980, pp. 102-109.

[17]Sotsialisticheskaya industriya (Socialist Industry), Moscow. June 7, 1980, p. 2; Jan. 17, 1981, p. 1.

[18]Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 52, December 1979, p. 9.

[19]———. Feb. 3, 1980, p. 2.

[20]Tsvetnye metally (Nonferrous Metals), Moscow. No. 11, November 1979, pp. 9-14; No. 12, December 1979, pp. 1-8.

[21]Work cited in footnote 20.

[22]Tsvetnye metally (Nonferrous Metals), Moscow. No. 7, July 1980, p. 32.

[23]Tsement (Cement), Moscow. No. 10, October 1980, pp. 2-3.

[24]Tsvetnye metally (Nonferrous Metals), Moscow. No. 3, March 1980, p.9.

[25]Sovetskiy shakhter (Soviet Miner), Moscow. No. 9, September 1979, pp. 1-2.

[26]Pravda, Moscow. Apr. 6, 1980.

[27]Stal' (Steel), Moscow. No. 7, July 1980, p. 547.

[28]Pravda, Moscow. June 9, 1980, p. 1.

[29]Tsement (Cement), Moscow. No. 11, November 1979, p. 2.

[30]Pravda, Moscow. Aug. 6, 1980, p. 2.

[31]Sovetskaya Rossiya (Soviet Russia), Moscow. Apr. 23-24, 1980. Sotsialisticheskaya industriya (Socialist Industry), Moscow. Apr. 5, 1980.

[32]Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 46, November 1979, p. 17.

[33]Planovoye khozyaystvo (Planned Economy), Moscow. No. 8, August 1979, pp. 14-28.

[34]Pravda, Moscow. July 28, 1977, p. 1; May 22, 1978, p. 1.

[35]Tsvetnye metally (Nonferrous Metals), Moscow. No. 3, March 1980, pp. 1-12.

[36]Work cited in footnote 35.

[37]Kazakhstanskaya pravda, Alma-Ata. Feb. 6, 1981, p. 3.

[38]Pravda, Moscow. May 31, 1980, p. 2.

[39]Tsvetnye metally (Nonferrous Metals), Moscow. No. 6, June 1980, p. 4.

[40]Work cited in footnote 35.

[41]Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 9, September 1980, p. 31.

[42]Kazakhstanskaya pravda, Alma-Ata. July 20, 1980, p. 2.

[43]———. June 18, 1980, p. 2.

[44]Vestnik Akademii Nauk (Herald of the Academy of Sciences), Moscow. No. 10, October 1980, pp. 3-14.

[45]Sotsialisticheskaya industriya (Socialist Industry), Moscow. Apr. 25, 1980, p. 1.

[46]Gazovaya promyshlennost' (Gas Industry), Moscow. No. 10, October 1980, pp. 2-3.

[47]Sotsialisticheskaya industriya (Socialist Industry), Moscow. Mar. 25, 1980, p. 2.

[48]Ugol' (Coal), Moscow. No. 7, July 1980, p. 6.

[49]Sotsialisticheskaya industriya (Socialist Industry), Moscow. May 11, 1980, p. 2.

[50]Izvestiya (News), Moscow. Apr. 24, 1980.

[51]Work cited in footnote 49.

[52]Tsement (Cement), Moscow. No. 9, September 1980, p. 2.

[53]Pravda, Moscow. June 11, 1980, p. 1.

[54]———. July 14, 1980, p. 1.

[55]Planovoye khozyaystvo (Planned Economy), Moscow. No. 3, March 1979, pp. 3-6.

Voprosy ekonomiki (Problems of Economics), Moscow. No. 7, July 1979, pp. 35-65, 131.

Pravda, Moscow. Sept. 2, 1979, p. 2.

[56]Stroitel'naya gazeta (Construction Gazette), Moscow. Aug. 1, 1980, p. 1.

[57]Pravda, Moscow. June 8, 1980, p. 1.

[58]Sotsialisticheskaya industriya (Socialist Industry), Moscow. Sept. 11, 1979, p. 2.

[59]Bezopasnost' truda v promyshlennosti (Labor Safety in Industry), Moscow. No. 1, January 1980, pp. 2-8.

[60]———. No. 8, August 1980, pp. 6-8.

[61]———. No. 10, October 1980, pp. 48-49.

[62]———. No. 12, December 1978, p. 18.

[63]———. No. 12, December 1980, p. 37.

[64]Kazakhstanskaya pravda, Alma-Ata. Sept. 4, 1980, p. 2.

[65]Bezopasnost' truda v promyshlennosti (Labor Safety in Industry), Moscow. No. 8, August 1979, pp. 49-50.

[66]———. No. 12, December 1979, pp. 50-53.

[67]———. No. 8, August 1980, pp. 58-60.

[68]Work cited in footnote 65.
[69]Work cited in footnote 66.
[70]Moscow. Radio, Nov. 24, 1980.
[71]Trud (Labor), Moscow. June 18, 1980, p. 2.
[72]Work cited in footnote 71.
[73]Work cited in footnote 71.
[74]Sotsialisticheskaya industriya (Socialist Industry), Moscow. June 3, 1980.
[75]Izvestiya (News), Moscow. Apr. 9, 1980.
[76]Pravda, Moscow. Mar. 31, 1980.
[77]———. June 5, 1980.
[78]Material'no-teknicheskoye snabzheniye (Material-Technical Supply), Moscow. No. 10, October 1980, pp. 50-53.
[79]Pravda, Moscow. Nov. 1, 1979, p. 3.
Trud (Labor), Moscow. Oct. 17, 1980, p. 2.
[80]Second work cited in footnote 79.
[81]Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 37, September 1980, p. 4.
[82]Work cited in footnote 78.
[83]Trud (Labor), Moscow. Oct. 17, 1980, p. 2.
[84]Pravda, Moscow. Feb. 4, 1981, p. 3.
[85]Tsvetnye metally (Nonferrous Metals), Moscow. No. 3, March 1980, pp. 1-12.
[86]———. No. 7, July 1980, p. 32.
[87]Sotsialisticheskaya industriya (Socialist Industry), Moscow. Feb. 20, 1980, p. 2.
[88]Gornyy zhurnal (Mining Journal), Moscow. No. 1, January 1980, p. 3; No. 1, January 1981, p. 3.
[89]Sotsialisticheskaya industriya (Socialist Industry), Moscow. Jan. 11, 1980, p. 2.
Tsvetnye metally (Nonferrous Metals), Moscow. No. 3, March 1980, p. 2.
[90]Kazakhstanskaya pravda, Alma-Ata. Apr. 13, 1979, p. 2.
[91]Sotsialisticheskaya industriya (Socialist Industry), Moscow. July 24, 1980, p. 1.
[92]Tsvetnye metally (Nonferrous Metals), Moscow. No. 4, April 1980, p. 8.
[93]———. No. 4, April 1980.
[94]Ekonomicheskaya gazeta (Economic Gazette), Moscow. Feb. 7, 1981, p. 5.
[95]Stroitel'nyye materialy (Construction Materials), Moscow. No. 4, April 1980, p. 3.
[96]Sotsialisticheskaya industriya (Socialist Industry), Moscow. Feb. 2, 1980, p. 2; Oct. 26, 1980, p. 2.
[97]Work cited in footnote 96.
[98]Trud (Labor), Moscow. Apr. 18, 1980.

The Mineral Industry of the United Arab Emirates

By Peter J. Clarke[1]

The petroleum sector continued to dominate the economy of the United Arab Emirates in 1980. Of the 626 million barrels of crude oil produced during the year, 620 million barrels were exported, bringing in revenues in excess of $19 billion.[2] Oil and gas production accounted for about 85% of the gross domestic product. Despite a decline in oil production of 6% from 1979 levels, revenues from crude oil exports increased 33%. The price of United Arab Emirates crude rose from an average $27.50 per barrel at the end of 1979, to about $34 per barrel by the end of 1980.

Efforts were continuing in 1980 to increase the role of the Federal Government in oil exploitation and marketing policy. The Ministry of Petroleum and Mineral Resources was responsible for general aspects of exploration and development of oil and mineral resources, but each Emirate still determined its own production and marketing policy. In November 1980, the Emirates General Petroleum Corp. (EGPC) was formed. EGPC was a 100% federally owned company that was to take over responsibility for marketing and distribution of petroleum products in the United Arab Emirates. EGPC's initial task was to take over the marketing operations in the six northern Emirates (everywhere except Abu Dhabi, where Abu Dhabi National Oil Co. (ADNOC) has sole marketing authority), currently controlled by the California-Texas Petroleum Co. (Caltex), Shell Oil Co., and British Petroleum (BP).

Consistent with this strengthening of the federal system was the establishment, on December 15, 1980, of a United Arab Emirates Central Bank to replace the Currency Board. The Central Bank was to have much the same authority as the Currency Board: To issue currency, regulate interest rates, and oversee the commercial banks. The Currency Board, however, had little influence because of its continual lack of federal funds or international reserves. In March 1980, the rulers of Abu Dhabi and Dubai agreed to channel 50% of their oil income to the Federal Government to stabilize the dirham and assure adequate liquidity in the local money market. The United Arab Emirates has been plagued by large capital outflows and correspondingly low liquidity levels because of fixed interest rates much lower than on international markets. A stronger reserve position in the Central Bank and the use of monetary policies was to provide greater access to funds within the country.

The fiscal year 1980 budget for the United Arab Emirates marked a reversal of the past 2 years' emphasis on decreased spending. The 1980 budgetary allocation was up 64% over the 1979 level, to $4.3 billion, most of which was to come from Abu Dhabi, although under the March agreement, Dubai's share was to increase significantly. Major allocations in the budget, by sector, were defense (28.2%), education and youth (8.7%), interior (8.6%), health (8.2%), electricity (3.4%), and public works and housing (2.5%). Individual Emirates were devoting increasing amounts of money into other sectors of the economy to diversify and increase their nonoil sources of revenue. Developmental spending for 1980 was up 65% over the previous year in the United Arab Emirates.

The Abu Dhabi Fund for Arab Economic Development continued to support development projects in the Arab and African world. Twelve projects in 10 countries received over $310 million from the fund

in 1980 including a petrochemical complex in Turkey, agriculture development in Mauritania, electricity projects in the People's Democratic Republic of Yemen, and phosphate fertilizers in Jordan.

Infrastructure development continued to be a top priority in the United Arab Emirates. In Abu Dhabi, the industrial complex at Ruweis was still under construction. The complex was to include the Abu Dhabi Gas Co. (Gasco) natural gas liquids (NGL) plant, a 120,000-barrel-per-day oil refinery, and a nitrogenous fertilizer plant, all of which were under construction during the year. Other plans for the complex were additional petrochemical industries and possibly an iron and steel foundry. Associated with these industries was a new deepwater port under construction at Ruweis and an oil export terminal at Zirku Island.

In Dubai, industrial development was centered around the complex at Jebel Ali. Already online in 1980 was the Dubai Aluminum Co. (Dubal) smelter and the Dubai Gas Co. (Dugas) gas-processing plant. Infrastructure for the complex included a planned 66-berth port in Jebel Ali, and an already completed 35-berth port in Port Rashid. The $500 million dry dock, built by Costain-Taylor Woodrow (United Kingdom) was also commissioned during the year, but attracted little business. Another harbor was under construction in Ras al-Khaimah.

The United Arab Emirates' mineral survey entered its third stage late in 1980. The survey was to be conducted by Hunting Geology and Geophysics Ltd. (United Kingdom), as were the first two stages, which involved location and delineation of previously unknown mineral resources. The third stage was to assess whether the mineral deposits that were discovered were commercially exploitable. The mineral survey had located copper deposits in Fujairah and chromite in Sharjah, Ajman, Ras al-Khaimah, and Fujairah, but no information on reserves or grade was available.

PRODUCTION AND TRADE

Abu Dhabi continued to dominate the petroleum sector in the United Arab Emirates, accounting for 79% of all crude oil produced in the country. Abu Dhabi produced 494 million barrels in 1980, Dubai produced 128 million barrels, and Sharjah produced 3.6 million barrels. Production declined about 6% from 1979 levels, owing to the imposition of production ceilings by ADNOC, but was expected to rise considerably as development of the large Upper Zakum Oilfield continued. The field, one of ADNOC's three offshore fields, produced about 50,000 barrels per day in 1980, but was expected to increase output to 500,000 barrels per day by 1984. Also, expansion plans were in progress for ADNOC's onshore Bu Hasa and Asab Oilfields, where additional reserves were discovered. With new fields onstream toward 1984, the United Arab Emirates was expected to have a production capacity of over 2 million barrels per day. Actual production was not a function of capacity, however, but rather a ministerial decision based on world demand, the price of oil on the spot market, and the desire to maintain productive capabilities over many years. Petroleum reserves in Abu Dhabi, Dubai, and Sharjah were estimated at 40 billion barrels.

Both Abu Dhabi and Dubai were to become significant exporters of NGL. Dugas came onstream in 1980, with a capacity of 100,000 barrels per day of NGL and 50,000 barrels per day of condensates. Gasco was due onstream in 1981, with a capacity of 100,000 barrels per day of NGL. The Das Island natural gas processing plant, which also produced NGL, liquefied petroleum gas (LPG), and pelletized sulfur, operated at about 60% of capacity during the year.

Both Dugas and Gasco were to supply Dubal's smelter, which began producing aluminum during 1980. The plant reached rated capacity late in the year. The plant was a significant step in diversifying the United Arab Emirates' economy away from oil dependence.

The only other major commodity produced in the United Arab Emirates was cement. Four cement plants were operating in 1980, in Abu Dhabi, Dubai, Ras al-Khaimah, and Sharjah. Nearly 1.5 million tons of cement was produced in the United Arab Emirates during the year, and capacity was to be upgraded to over 3 million tons by 1982. Mineral production in the United Arab Emirates is shown on table 1.

The United Arab Emirates' balance-of-trade surplus continued its rapid growth in 1980, rising from $4.6 billion in 1978, to $9 billion in 1979, and $12.5 billion in 1980. Even with a substantial rise in the level of imports, which were steady at about $5 billion in 1977-78, then rose to $6.5 billion in 1979, and nearly $8 billion in 1980, the

United Arab Emirates was left with a $9.5 billion current account surplus. Proper management and investment of these massive surpluses remained a major challenge to the United Arab Emirates Government. Partly because of the country's unprofitable interest rate structure, and also because of the need to recycle large sums of money without inflating the local economy, a considerable (but unspecified) portion of petroleum revenues were invested in foreign markets, mainly by the Abu Dhabi Investment Authority. The Central Bank was expected to continue this policy, while also allowing for more profitable investment within the country.

Exports of oil and gas accounted for about 95% of the United Arab Emirates' total exports in 1980. Oil was exported to Japan (30%), the United States (12%), France (11%), Netherlands Antilles (10%), the Netherlands (7.3%), the Federal Republic of Germany (5.4%), Ireland (3%), and India (2.4%). Other recipients of 10 million barrels or less were other Western European countries, and African and Middle Eastern countries, including Tanzania, Kenya, Ivory Coast, Egypt, Mozambique, Ethiopia, Morocco, and the People's Democratic Republic of Yemen.

Aluminum exports also began for the first time in 1980. About 40% of the output of the Dubal smelter was exported to the United States, and 40% went to the United Kingdom, with the remainder being sold within the United Arab Emirates and other Middle Eastern countries.

Besides receiving most of the United Arab Emirates' oil, Japan and the United States were also the major suppliers of imports into the Emirates, with the United Kingdom, the Federal Republic of Germany, and France also important trading partners. The major imported goods were

Table 1.—United Arab Emirates: Production of mineral commodities[1]

Emirate,[2] commodity,[3] unit of measure	1976	1977	1978	1979[p]	1980[e]
ABU DHABI					
Cement, hydraulic[e] thousand metric tons	200	200	200	200	200
Gas, natural:					
Gross production million cubic feet	544,196	541,760	478,617	483,809	536,600
Marketed production do	37,787	111,876	177,914	189,286	200,000
Natural gas liquids thousand 42-gallon barrels	--	8,411	4,983	15,000	15,000
Petroleum:					
Crude do	580,476	602,761	527,827	533,995	[4]492,154
Refinery products:					
Gasoline do	554	1,073	1,132	[e]1,500	1,500
Kerosine do	22	188	328	[e]400	400
Distillate fuel oil do	963	1,390	1,314	[e]1,600	1,600
Residual fuel oil do	702	1,045	1,095	[e]1,400	1,400
Other do	9	37	73	[e]100	100
Refinery fuel and losses do	127	306	323	[e]500	500
Total do	2,377	4,039	4,265	[e]5,500	5,500
AJMAN					
Marble[e] square meters	26,000	26,000	26,000	26,000	NA
DUBAI					
Aluminum, primary ingot metric tons	--	--	--	--	25,000
Cement, hydraulic thousand metric tons	--	--	370	400	500
Gas, natural:[e]					
Gross production million cubic feet	127,600	130,000	147,000	[r]144,000	142,000
Marketed production do	20,000	31,000	30,600	31,000	36,500
Petroleum, crude thousand 42-gallon barrels	114,704	116,472	132,240	129,316	[4]127,818
RAS AL-KHAIMAH					
Cement, hydraulic thousand metric tons	450	450	450	450	500
SHARJAH					
Cement, hydraulic do	--	50	263	300	300
Gas, natural, gross production[e 5] million cubic feet	15,000	15,000	15,000	[r]8,700	6,600
Petroleum, crude thousand 42-gallon barrels	13,542	10,293	8,067	4,697	3,586

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 24, 1981.

[2]In addition to the Emirates listed, Fujairah and Umm al-Qaiwain record no mineral production but presumably produce small quantities of crude construction materials.

[3]In addition to the commodities listed, crude construction materials such as common clays, stone, and sand and gravel presumably are produced, but output is not recorded quantitatively and general information is inadequate to make reliable estimates of output levels.

[4]Reported figure.

[5]No marketed production is reported; there is probably some small field use.

machinery, transportation equipment, manufactured goods, and foodstuffs. The United States received about 14% of the United Arab Emirates' exports, valued at $2.8 billion and supplied 12.2% of its imports, with a value of $922 million for 1980.

Table 2.—Abu Dhabi: Exports of crude oil, by destination

(Thousand 42-gallon barrels)

Country	1976[r]	1977	1978	1979
Australia	219	2,081	NA	NA
Canada	2,847	--	NA	NA
France	75,920	72,708	NA	NA
Germany, Federal Republic of	17,885	32,741	NA	NA
Italy	14,344	11,899	NA	NA
Japan	191,476	191,005	NA	NA
Netherlands	66,576	87,126	NA	NA
United Kingdom	38,252	25,842	NA	NA
United States	80,336	101,580	NA	NA
Other	89,721	74,604	NA	NA
Total	577,576	599,586	522,586	523,592

[r]Revised. NA Not available.

Source: Organization of Petroleum Exporting Countries, Statistical Unit. Annual Statistical Bulletin 1979, Vienna, 1979, p. 77.

COMMODITY REVIEW

METALS

Aluminum.—Production from Dubal's primary smelter began in November 1979. During 1980, all three potlines were brought onstream, and the plant reached rated capacity of 135,000 tons per year in December 1980. The Dubai Government owned 80% of Dubal, and Alusmelter Holdings, a Grand Caymen Co., owned 37.5% by Southwire Co. of Carrollton, Ga. (United States), and Selection Trust Ltd. (United Kingdom) owned the remaining 20%. The Dubai Government announced in March 1980 its intention to take over the minority interests at an unspecified time, providing full and fair compensation.

The Dubal smelter was part of a threefold project which included a 515-megawatt power-generating facility, supplied by Hawker Siddeley Power Engineering Co. (United Kingdom), and a 25-million-gallon-per-day desalinization plant, built by Weir-Westgarth (United Kingdom). Desalinated water was used at the smelter and also by surrounding industries and the population of Dubai. The powerplant was one of the world's largest industrial gas turbine power stations outside North America. The plant provided power for the smelter as well as steam and electricity for the desalinization plant. Average gas input was 3.15 million cubic meters per day. Gas was supplied by Dugas.

The smelter itself was one of the world's most modern facilities. Computers controlled a major part of the operation, from reduction and anode production, to power and desalinization. The management contractor for the plant was British Smelter Constructions. The complex was located in Jebel Ali, 30 kilometers from Dubai center, and took 32 months to complete. The main features were a 135,000-ton-per-year smelter, comprising 3 potlines, 6 pot rooms, a rodding room, pot repair facilities, a cast house, full workshop and warehouse facilities, training and administration facilities, and housing for 4,000 construction personnel. In addition, a port was expanded at Mina Jebel Ali to handle 500,000 tons per year of supplies and raw materials.

Raw materials for the plant were, at full rated capacity, 260,000 tons per year of alumina, 60,790 tons per year of petroleum coke, and 16,725 tons per year of pitch, along with the gas to drive the turbines. Alumina was supplied by Alcoa of Australia, under a contract providing 200,000 tons per year for a 10-year period.

Dubal was under contract to supply 40% of its output to Southwire Co., and 40% to a British unit of Alcan Aluminum Ltd., and the rest was sold by the Government of Dubai. These contracts were being renegotiated during the year, mainly owing to a rise in the price of alumina and aluminum on world markets. A new agreement was to

specify new offtake percentages for Alcan and Southwire, and also provide some definition of marketing areas.

Aluminum fabricating was given a considerable boost by the opening of the Dubal smelter. Gulf Extrusions Ltd. brought Dubai's first aluminum extrusion plant into production in 1978. The plant, built at a cost of $12 million, could produce 3,000 tons per year of anodized architectural sections in polished or etched finishes. The company was owned by the Al-Ghurain group, and was built by British Smelter Constructions. The company had obtained all its billits from Aluminum Bahrain Ltd. before the Dubal smelter began operating in 1979, when it switched to all Dubal feed. Output was marketed by the company and primarily sold to Arabian Aluminum Co., a fabricating associate in which Al-Ghurain had an interest, and other small fabricators around the Middle East.

A plant producing electrical distribution cables made of aluminum and copper came onstream in October 1979. The Dubai Cable Co., or Ducab, began producing building wires in June of 1979 and power cables in October. The company was a joint venture of British Insulated Callender's Cables N.V. (Netherlands) and the Dubai Government. Operations in the factory included wire drawing from copper or aluminum rod, stranding wires into flexible conductors, polyvinyl chloride insulating, and testing procedures. The plant expected to utilize 1,100 tons per year of imported copper rod and 500 tons per year of aluminum from Dubal.

Iron and Steel.—Feasibility studies were undertaken in 1979 for establishing an iron and steel mill in the industrial city of Ruweis in Abu Dhabi. A $200,000 contract for the study was awarded to Eisenbau A.G. (Federal Republic of Germany). The plant was to produce 400,000 tons per year of steel, and use locally produced natural gas. Preliminary agreements were drawn up in 1979 to operate the mill as a joint venture between India and ADNOC, with iron ore and technology being supplied by India. No decisions were made in 1980 to begin construction of the proposed mill.

There were two operating steel mills in the United Arab Emirates in 1980. Abu Dhabi Steel Works operated a 25,000-ton-per-year reroller, which began operating in 1977, and Ahli Steel Co. (formerly Gulf Steel Mills Ltd.) was established in Dubai in 1974. The Ahli works include a 12-ton electric furnace with an annual capacity of 36,000 tons, a 2-strand continuous billet caster, and a 10-ton-per-hour continuous bar mill.

NONMETALS

Asbestos.—An asbestos plant in Umm al-Qaiwain was inaugurated in June 1979. The $22 million plant was the first major industrial project in the Emirate. Construction of the plant began in 1977 and was financed mostly from loans from the Emirates Development Bank. The plant had an annual production capacity of 40,000 tons of asbestos pipes, sheets, and plates, and was capable of expansion at a later stage to 120,000 tons per year to meet export demand.

Cement.—Cement production increased to 1.5 million tons in 1980 from 1.3 million tons in 1979, as production from the Dubai National Cement Co. reached capacity. The plant came onstream early in 1979. There were four operating cement plants in the United Arab Emirates in 1980, in Abu Dhabi, Dubai, Ras al-Khaimah, and Sharjah, all of which operated near capacity. New cement plants were planned for Fujairah and Ras al-Khaimah. Fujairah Cement Industries of Dibba contracted Voest-Alpine A.G. (Austria) for the construction of a 580,000-ton-per-year turnkey plant, due for completion in 1981. The Gulf Cement Co., a joint venture of the United Arab Emirates Government and Kuwait, planned to construct a 1-million- ton-per-year cement plant in Ras al-Khaimah, principally to supply markets in Kuwait. Current and planned production capacity of the Emirates cement plants is as follows:

Location	Operating company	Current capacity (metric tons)	Planned capacity (year) (metric tons)
Al Ain, Abu Dhabi	Al Ain Cement Factory	200,000	200,000
Dubai	Dubai National Cement Co	500,000	500,000
Fujairah	Fujairah Cement Industries	--	580,000 (1981)
Ras al-Khaimah	Union Cement Co	500,000	500,000
Do	Gulf Cement Co. (United Arab Emirates-Kuwait)	--	1,000,000 (1982)
Sharjah	Sharjah Cement Co	300,000	300,000

Fertilizer Materials.—In October 1980, a joint venture company was set up to construct and operate a $300 million nitrogenous fertilizer plant at the Ruweis Industrial Complex in Abu Dhabi. The agreement for the plant was signed in May 1979 between ADNOC and Compagnie Francaise des Petroles (CFP) (France). ADNOC was to own 66% of the equity, and CFP 33%. The company was formed by a law issued by the ruler of Abu Dhabi, following the initial feasibility studies carried out by Snamprogetti (Italy) in 1979. The plant was to have a production capacity of 1,000 tons per day of ammonia and 1,500 tons per day of urea, mostly for export. Startup was scheduled for 1983 or 1984.

In July 1980, Mitsubishi and Chiyoda Chemical Engineering and Construction Co. (Japan) were awarded a $200 million contract for construction of the plant. In addition to the ammonia and urea plants, ancillary facilities were to include an export terminal, a gas pipeline from Habshan, and a desalinization-powerplant. Natural gas from Abu Dhabi's onshore fields was to be used as feedstock for the producing units and as fuel for the power station.

The Sharjah fertilizer plant increased its production capacity from 10,000 to 35,000 tons per year in 1979. The $5 million facility, which came onstream in 1978, produced chemical fertilizer for the local market.

MINERAL FUELS

Natural Gas.—The Ruweis gas project was near completion at the close of 1980. The project was implemented by Gasco, a joint venture between ADNOC (68%), Shell Oil Co. (United States) (15%), CFP (15%), and Participations and Exploration Corp. (Partex) (Portugal) (2%). The Ruweis facility was designed to process 800 million cubic feet per day of associated gas, and to produce 150,000 barrels per day of NGL, with a product split of 60% NGL and 40% condensate. The plant was to treat associated gas from Abu Dhabi's onshore fields; Asab, Bu Hasa, Bab, and Sahil. The plant was scheduled to come onstream in March 1981.

Most of the expected output from the Ruweis plant was already sold to eight Japanese companies under 5-year supply contracts. The contracts required the supply of 1.49 million tons per year of LPG, 75% of which was to be derived from ADNOC's share of total output. The customers were Idemitsu Kosan (250,000 tons per year), Mitsui Bussan and Bridgestone (400,000 to 450,000 tons per year), C. Itoh and Co. (120,000 tons per year), Mitsubishi Shoji (120,000 tons per year), Maruzen Sekiyu (100,000 tons per year), and Showa Sekiyu (100,000 tons per year). CFP and Partex, also shareholders in Gasco, signed contracts with Marubeni (300,000 tons per year) and Idemitsu (50,000 tons per year).

A pipeline linking the onshore fields to the Ruweis facility was completed late in 1980. C-E Crest, a subsidiary of Combustion Engineering (United States), initiated work on the line and associated subsystems in 1978. The cost of the pipeline was $60 million.

The Das Island natural gas processing plant continued to operate below capacity in 1980, owing both to technical difficulties at the facility and decreased output from the offshore fields. The plant was designed to process 550 million cubic feet per day of associated gas from the offshore fields of Umm Shaif and Upper and Lower Zakum, for the annual production of 15 million barrels of liquefied natural gas (LNG), 5.6 million barrels of LPG, 1.5 million barrels of light distillate, and 1.6 million barrels of pelletized sulfur. About 113 billion cubic feet of natural gas was supplied to Das Island during the year, which represents about 60% of capacity. The Das Island plant, which began operating in October of 1977, was operated by the Abu Dhabi Gas Liquefaction Co. Ltd., a joint company composed of ADNOC (51%), BP (16%), CFP (8%), Mitsui and Co. (Japan) (22%), and Bridgestone Liquefied Gas Co. Ltd. (Japan) (3%). Nearly all of the output of the plant was sold to the Tokyo Electric Power Co. under a 20-year contract.

Tenders were being taken during the year for construction of seven storage tanks at Das Island. The work involved building three 80,000-cubic-meter tanks to store LNG, and four other tanks, two for propane and two for butane. Closing date for submission of tenders was December 31, 1980.

In April 1980, Dubai opened its own natural gas processing plant, designed to utilize Dubai's production of about 100 million cubic feet per day of natural gas, from the offshore fields of Rashid, Fateh, and Southwest Fateh. The plant was owned by Dugas, a joint venture of the Dubai Government and Scimitar Oils Ltd. (formerly Sunningdale Oils Ltd.) of Canada. The plant, designed by Hudson Engineering of Hous-

ton, Tex. (United States), was to produce 11,000 barrels per day of propane, 7,000 barrels per day of butane, 7,000 barrels per day of condensates, and 55 million cubic feet per day of residue gas. Most of the propane, butane, and natural gasoline was contracted to Japanese buyers. The residue gas was used to drive the generators producing power for Dubal's aluminum smelter. Residue gas output from Dugas was still insufficient to drive all the turbines at Dubal. Dubai was negotiating with Abu Dhabi during the year for supplies of residue gas from the Ruweis plant once completed.

The Government of the United Arab Emirates announced, for the first time in 1980, that the price of LNG was linked to the price of Abu Dhabi's Murban crude oil. LNG prices jumped from $2.36 per 1 million British thermal unit (Btu) equivalents, to $4.00 per 1 million Btu's, based on a January 1 price of $21.56 per barrel of Murban crude. Any further increase in the price of the Emirates oil was to have an automatic effect on LNG prices.

Several new gas discoveries were made during the year, significantly boosting the United Arab Emirates' total reserves of natural gas. A new field was discovered offshore Abu Dhabi, at Umm Shaif, midway between Abu Dhabi and Qatar, at a depth of 15,000 feet: Umm Shaif was already a significant producer of petroleum and associated gas. The new gasfield contained an estimated 24 trillion cubic feet of natural gas, enough to more than double the Emirates' total reserves. The field was operated under the authority of the Abu Dhabi Marine Areas Operating Co. (ADMA-OPCO), which was owned 60% by ADNOC, 14.6% by BP, 13.3% by CFP, and 12.1% by the Japan Oil Development Co. (JODCO).

Amoco International Oil Co. had a major gas-condensate discovery on its 600,000-acre onshore concession in the Emirate of Sharjah. The well was believed to be capable of producing 50 million cubic feet per day of gas, and 9,650 barrels per day of condensate. The well, located near the Shaikdom's western coast, was drilled to a depth of 16,000 feet. At yearend, Amoco was formulating plans to develop the field.

Petroleum.—*Abu Dhabi.*—Crude oil production in the United Arab Emirates totaled 626 million barrels in 1980. Abu Dhabi supplied over 75% of the total, about 494 million barrels, of which 489 million barrels were exported. Abu Dhabi operated its oilfields under production ceilings, which were determined by the petroleum minister in conjunction with the operating company. Total production in Abu Dhabi declined 7.5% from 1979 levels owing to a lowering of these production ceilings during the year. A temporary increase in production was ordered in October 1980 to help offset the loss of exports from Iran and Iraq. Further production cuts were ordered to take effect in January 1981, to conserve the reserves of the Emirate.

The Abu Dhabi Co. for Onshore Oil Operations (ADCO) produced oil from four onshore fields; Bu Hasa, Bab, Asab, and Sahil. Shares in ADCO were held 60% by ADNOC, 9.5% by BP, 9.5% by CFP, 9.5% by Shell, 4.75% by Exxon, 4.75% by Mobil, and 2% by Partex. Total production from the onshore fields was 267 million barrels in 1980. Production ceilings were lowered for the onshore fields in August 1980. The Bu Hasa Field ceiling was lowered from 365,000 to 295,000 barrels per day as a new gas-lift, water injection scheme became operational, providing a 1-million-barrel- per-day water injection capacity. Ceilings for the other fields remained the same: Bab (50,000 barrels per day), Asab (300,000 barrels per day), and Sahil (25,000 barrels per day). The onshore fields were not affected by the production increase in October, and further production cuts were planned for January 1981, calling for a 600,000-barrel-per-day ceiling for the onshore fields. A development plan was underway during the year for expanding the output of the north Bu Hasa Field. Exploration revealed additional reserves of up to 1 billion barrels, in both the Bu Hasa and Sahil Fields.

Abu Dhabi's offshore fields were administered by ADMA-OPCO, which was owned 60% by ADNOC, 14.67% by BP, 13.33% by CFP, and 12% by JODCO. ADMA-OPCO operated three fields: Umm Shaif, which produced 250,000 barrels per day; Lower Zakum, which produced 200,000 barrels per day; and Upper Zakum, which produced 50,000 barrels per day. The Upper Zakum Field was undergoing further development and was expected to be capable of producing 500,000 barrels per day by 1984. An export terminal was under construction at Zirqu Island to handle the expected output from the Zakum Fields. The Zakum Development Co. (ZADCO), a joint venture of ADNOC and CFP, was constructing the facility, which was due for completion in 1981. The produc-

tion ceiling for Upper Zakum was lowered to 40,000 barrels per day in August 1980, and then the overall ceiling for all offshore fields was raised in October to allow a 50,000-barrel- per-day increase to help offset supplies lost from Iran and Iraq. An increase of 35,000 barrels per day was to come from the ADMA-OPCO fields, and the remaining 15,000-barrel-per-day increase was to come from smaller offshore fields. These fields were the Abu Al Bukhoosh Field, operated by the Total Group (France) which produced 75,000 barrels per day, the Arzanah Field, operated by Amerada-Hess (United States), and the Mubarraz Field, operated by JODCO, both of which produced 20,000 barrels per day. All of the increased output from the ADMA-OPCO fields and the independent fields was sold under special contract to France.

After a year of inactivity, production was scheduled to resume from the offshore Bunduq Field, on the Abu Dhabi-Qatar border. The main operator, the United Petroleum Development Co. of Japan (UDC) agreed to initiate a $230 million water injection recovery scheme, scheduled for completion in 1983. The field was to resume production in 1981 at around 5,000 barrels per day. Output from the field in 1976-77 averaged 20,000 barrels per day.

Plans were made during 1980 for the development of three new offshore fields in Abu Dhabi. ADNOC and JODCO signed an agreement in July to develop the Delma, Satah, and Jarnain offshore fields, and to construct a 40,000-barrel-per-day export terminal at Delma Island. Development plans included construction of an oil-gathering center, several platforms, a pipeline network, a gas-oil separation unit, a powerplant, storage tanks, and worker housing. Total cost of the project was $700 million; $300 million of which was to be provided by JODCO, and the remaining $400 million was to be supplied in a soft loan from ADNOC. The project was to be carried out by the Umm Addalkh Development Co., a 50:50 venture of ADNOC and JODCO. Reserves at the three fields were estimated at 1 billion barrels.

ADNOC had a significant new discovery during 1980. Oil was discovered at an offshore exploratory well at Bu Tinah, 57 kilometers from the Abu Dhabi coast and 26 kilometers south of Zirku Island. Reserves at Bu Tinah were estimated at 1 billion barrels, and further exploration was slated for 1981.

Several new exploration agreements were signed during 1980 with ADNOC and the Abu Dhabi Government. A 7,880-square-kilometer concession was awarded to a consortium headed by Sceptre Resources of Canada. The agreement involved a minimum exploration expenditure of $70 million over 10 years. The area was located southeast of the Abu Dhabi town.

Amoco was awarded a 2,500-square-kilometer concession north of Al Ain. The exploration commitment was $55.5 million over 8 years, with bonuses of $5 million on signature, $2 million for a commercial find, and incremental bonuses of $2 million when exports hit 50,000, 100,000, and 200,000 barrels per day.

Amerada-Hess, Occidental Petroleum Co., and Alpha acquired two exploration blocks totaling 2 million acres. Seismic work was to begin midway through 1981. The drilling commitment was 30,000 feet.

Petroleum refining capacity in Abu Dhabi was undergoing large-scale expansion during 1980. Pullman Kellog (United States) finalized a contract with ADNOC for construction of a second refinery at Umm al-Nar. The new refinery was to have a capacity of 60,000 barrels per day, and was to be located adjacent to the 15,000-barrel-per-day refinery already operating at Umm al-Nar. The 75,000 barrels per day of total output from Umm al-Nar was expected to meet domestic requirements.

Meanwhile, construction was nearing completion on the 120,000-barrel -per-day export refinery in the Ruweis Industrial Complex. The $650 million facility was being constructed by Snamprogetti (Italy) and was scheduled to come onstream in August 1981. The possibility was being studied of expanding the Ruweis refinery to 250,000 barrels per day at some time in the future.

The United Arab Emirates and India agreed to participate in a joint venture refinery to be located on the western coast of India. The 250,000-barrel- per-day refinery, in which the Emirates had a 50% interest, was to receive crude oil feedstock from the Emirates, and in return the Emirates would share the output of refined products with the Indian Government. No date for construction was available.

Abu Dhabi's first lube oil blending plant was completed in mid-1980 at Umm al-Nar. The plant was built by Balmer Laurie Co. of India and had a capacity of 14,000 tons per year of 50 types of lubricants for the local

market. The plant was owned by ADNOC's subsidiary, the Abu Dhabi National Oil Co. for Distribution.

A drilling mud plant was also inaugurated during the year. The plant, which cost $28 million, was built by AODCAP, a joint venture of ADNOC and NL Industries. The plant was located at Sa'diyat Island in Abu Dhabi.

Several pipeline projects were being considered by the Government of Abu Dhabi during the year. A pipeline to transport petroleum products from the Umm al-Nar refinery to Abu Dhabi City was approved in July. Another pipeline between Abu Dhabi City and Al Ain was being considered. Also under review was a 150-mile crude oil pipeline, running from Abu Dhabi, across the Musandam Peninsula, to Fujairah on the Gulf of Oman. The pipeline was to provide an outlet for crude oil exports should the Straits of Hormuz be blocked for any reason. The Abu Dhabi National Oil Co. also decided to build a major gasline between Abu Dhabi and Dubai to provide Dubal with supplemental supplies of natural gas feedstock.

With the approval of the Abu Dhabi Executive Council, ADNOC increased its working capital from $55 million to over $2 billion late in 1980. The Director General of ADNOC stated that the large increase would enable the company to undertake ambitious investment projects in the 1981-86 period, which were estimated at $10 billion. Among these plans were the Umm al-Nar and Ruweis refinery, several petrochemical projects, tanker purchases and port expansions, and natural gas development. The Director General also stated that from 1971 to the end of 1979, ADNOC realized a clear profit of nearly $4.5 billion.

Dubai.—The Dubai Petroleum Co. (DPC) operated four offshore oilfields; Fateh, Southwest Fateh, Falah, and the Rashid condensate field. Total crude oil production in the Emirate in 1980 was about 129 million barrels, of which 128 million barrels were exported. The Falah and Rashid Fields were undergoing further development during 1980, and output from these fields was expected to increase. Companies operating the concessions were DPC (owned by Conoco) (30%), Dubai Marine Areas (DUMA) owned jointly by CFP and Hispanoil (50%), Deutsche Texaco (10%), Dubai-Sun Oil Co. (United States) (5%), and Delfzee, a subsidiary of Wintershall A.G. (Federal Republic of Germany) (5%).

In August 1979, the Dubai Government reached an agreement with Conoco to purchase from the company 100,000 barrels per day of crude oil from August through October and 180,000 barrels per day in November and December, at 93% of the posted price. The operating companies then had the option to buy back the oil at prices set by the Government. For the second half of 1979, Conoco repurchased 33% of the oil it was required to sell to the Emirate.

Dubai struck oil onshore in 1980, at an exploratory well at Jebel Ali. The well was drilled on a concession held by Sedco-Houston Oil and Minerals (United States), and reached a depth of 17,875 feet. The Sedco-Houston oil well was the first onshore well drilled in Dubai in 12 years. Further test wells were underway to determine the size of the field.

Arco-Dubai, a wholly owned subsidiary of Atlantic-Richfield Co. (ARCO) (United States), was awarded a 760,000-acre, 35-year concession for onshore oil exploration and development. The agreement stipulated a $1 million investment on geophysical work, and a $5 million investment for each well drilled. ARCO must drill one well by the third year, and one well every year for 5 years after that, if preliminary tests are encouraging.

Dubai officially inaugurated its $300 million Jebel Ali power generating desalinization complex in June 1980. The plant was capable of producing 300 megawatts and 2.8 million gallons per day of fresh water. The powerplant was expected to supply 90% of Dubai's power needs in 1980.

Sharjah.—Oil production for Sharjah's offshore Mubarek Field averaged about 10,000 barrels per day in 1980. Total production for the year was 3.61 million barrels. Output of the field declined considerably from a high of 40,000 barrels per day in 1975. The production drop was due to both technical difficulties and the start of a new gas-water injection scheme, designed to restore the field's output to previous levels. The Mubarek Field was operated by Buttes Gas and Oil Co., a subsidiary of Crescent Petroleum (United States). Half the revenues of the field go to Iran, following an agreement in 1971 establishing Iranian cosovereignty over the offshore area.

In February 1980, London and Scottish Marine Oil Co. (LASMO) in partnership with Forman Exploration (United States) discovered natural gas in two zones from the first test well in the Hamriyyah region,

32 kilometers off the Sharjah coast. The well was drilled to 14,440 feet and yielded flow rates of 8 and 6.4 million cubic feet per day. The LASMO-Forman lease called for $10 million in exploration expenditure over 35 years.

Amoco Sharjah Oil Co. (a subsidiary of Standard Oil of Indiana) also struck gas and condensate on its 600,000-acre onshore concession in December 1980. The well was drilled to 15,000 feet, and flowed between 5 and 23 million cubic feet per day of natural gas, and 4,650 barrels per day of condensate. Amoco was making plans to develop the field, which was thought capable of becoming a significant producer of light crude and condensate within 3 or 4 years.

Ajman.—Seismic work was completed in 1980 on a 300-square-kilometer offshore concession awarded to Forman Exploration (United States) and London and Scottish Marine Oil Co. in 1978. The agreement called for $10 million in exploration expenditures over a 35-year period. The first test well was due to spud late in 1980 or early in 1981.

Fujairah.—After 4 years of preliminary work, Fujairah began drilling its first exploratory well in August 1980. A consortium of Denison Mines (Canada) (50%), Getty Oil Co. (United States) (15.7%), Mitsubishi Oil Co. (Japan) (10%), and 15 other companies operated a 700,000-acre concession off the coast of Fujairah. The concession was originally awarded to Reserve Oil and Gas in 1975, but was taken over by Getty in January 1979, when the companies merged. Denison financed 75% of the $13 million cost of spudding the first well. Mitsubishi planned to set up a wholly owned subsidiary, the Fujairah Oil Exploration and Development Co., to assist in developing the concession.

Ras al-Khaimah.—Plans to become the fourth oil-producing Emirate evaporated in 1980. Discoveries by Vitol-Deutsche Schachtbau (Federal Republic of Germany) have proved uncommercial. Plans were also canceled for a 150,000-barrel-per-day refinery in Khor, Kuwait. The refinery was to use Kuwait crude oil, but with production cutbacks in that country the plan was ruled out.

Amoco joined Gulf Oil Corp. in a concession covering all onshore areas and territorial waters in Fujairah. The group planned to drill its first exploratory well late in 1980 at Khatt.

Umm al-Qaiwain.—After a promising gas find in 1977, which tested at 41 million cubic feet per day, subsequent wells delineated a minor gasfield, uncommercial either for power generation or export to Dugas. The five-company group, led by Canadian Superior, with Zapata as operator, decided to terminate the concession in 1980. No further exploration activity was underway.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from United Arab Emirates dirhams (UAED) to U.S. dollars at the rate of UAED3.88 = US$1.00.

The Mineral Industry of the United Kingdom

By William F. Keyes[1]

The gross domestic product of the United Kingdom in real terms dropped by 1.6% in 1980, although at current prices it reached £191 billion (at factor cost), an increase of 16%.[2] The inflation rate slowed to just under 17%.

Although steel production fell to its lowest postwar level and the British Steel Corp. (BSC) suffered another large operating deficit, production of fuels rose. Coal production, with the customary Government subsidy, rose about 6%, and petroleum from North Sea fields at last made the country independent of imports.

In May, the Government announced that it was to embark on a round of discussions with United Kingdom mining, industry, and financial institutions concerning means to assure availability of essential minerals and metals. A number of papers and comments were contributed during the year by such bodies as the Mining Association of the United Kingdom and the Foreign Affairs Research Institute. The gist of the contributions was that support should be considered for recycling and conservation measures, stimulation of overseas exploration by British interests, technical and financial assistance for development of domestic mines, other financial measures, and stockpiling of strategic minerals.

At yearend, the Government introduced into Parliament a bill to license British companies to explore and exploit undersea nodules until the United Nations Law of the Sea Treaty came into force. The brunt of the proposed law was to prohibit United Kingdom citizens and companies from mining deepsea nodules outside territorial waters without a permit from the Government. It then protects such licenses from interference from whatever source. When such interference is from outside the United Kingdom, or by countries with discriminatory laws against such mining, licensees could be restrained from using ships of that country, and other measures could be applied. Cooperation with other countries with similar legislation, such as the United States and the Federal Republic of Germany, was envisioned.

PRODUCTION

The index of industrial production declined from 112.6 in 1979 to 105.0 in 1980, but the index of mining and quarrying increased from 294.8 to 300.4, largely owing to an increase of the petroleum and natural gas factor from 31,138 to 31,887.

Production of minerals in the United Kingdom for the last 5 years is given in table 1.

Table 1.—United Kingdom: Production of mineral commodities[1]

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Aluminum:					
Alumina	96	99	94	88	102
Metal:					
Primary tons	334,535	349,725	346,200	359,474	374,446
Secondary do	205,848	200,848	193,748	176,696	162,056
Cadmium metal including secondary do	190	295	291	424	375
Copper:					
Ore and concentrate, metal content do	600	450	135	e100	--
Metal, refined:					
Primary do	r51,557	44,397	46,158	48,512	68,290
Secondary do	r85,680	77,827	79,403	73,185	93,048
Total do	137,237	122,224	125,561	121,697	161,338
Iron and steel:					
Iron ore gross weight	4,582	3,745	4,239	4,268	916
Iron content	1,100	899	1,102	1,110	238
Metal:					
Pig iron	r13,891	r12,285	11,532	12,894	6,360
Ferroalloys, blast-furnace: Ferromanganese	r123	97	69	136	52
Steel, crude	22,274	r20,410	20,311	21,438	11,278
Semimanufactures:					
Sections	5,238	4,878	4,949	4,937	3,414
Wire rods	1,538	1,650	1,423	1,760	972
Plates and sheets	7,144	6,821	6,858	7,383	3,802
Strip	1,264	1,134	1,144	1,134	413
Pipe, tube, stock	711	687	727	647	433
Railway track material	226	262	233	257	176
Other rolled[2]	978	1,081	1,014	1,003	873
Casting and forgings	360	338	307	275	252
Total	17,459	16,851	16,655	17,396	10,335
Lead:					
Mine output, metal content tons	7,100	7,753	4,582	4,701	2,400
Metal:					
Bullion from imported ores and concentrates do	16,502	35,015	30,371	32,314	30,039
Refined:					
Primary[3] do	132,157	139,654	122,841	124,138	113,405
Secondary[4] do	209,711	211,424	222,947	244,192	211,385
Total do	341,868	351,078	345,788	368,330	324,790
Magnesium metal, including secondary do	3,000	2,700	2,700	2,700	e2,700
Nickel metal, refined, including ferronickel do	33,125	23,156	21,367	18,863	19,300
Silver metal thousand troy ounces	108	134	41	NA	NA
Tin:					
Mine output, metal content tons	3,323	4,100	3,132	2,373	3,027
Metal:					
Primary do	11,161	10,458	8,445	8,025	5,829
Secondary do	2,545	3,398	2,711	3,367	5,535
Tungsten, mine output, metal content do	e10	78	65	66	e70
Zinc:					
Ore and concentrate, metal content do	4,800	7,551	2,718	572	4,400
Metal, smelter do	41,583	81,481	73,575	76,686	86,682
NONMETALS					
Barite and witherite	50	50	54	45	40
Bromine tons	29,900	24,700	25,100	29,200	25,000
Calcite	16	14	13	21	NA
Cement, hydraulic	15,780	15,456	15,916	16,140	14,808
Chalk	15,941	16,253	16,731	16,265	e16,000
Clays:					
Fire clay	1,513	1,764	1,404	1,711	NA
Fuller's earth	201	223	218	220	e200
Kaolin (china clay)	3,847	4,338	4,199	4,444	e4,100
Pottery clay and ball clay	14	16	16	22	NA
Other, including clay shale	26,229	24,378	25,473	21,645	NA
Diatomite tons	3,500	2,000	2,000	2,000	e2,000
Feldspar (china stone)[e] do	50,000	50,000	50,000	50,000	50,000
Fluorspar:					
Acid-grade	134	105	130	104	e100
Metallurgical-grade	29	23	16	12	e10
Ungraded	54	66	43	38	e40
Total	217	194	189	154	150
Gypsum and anhydrite[5]	3,350	3,310	3,322	3,500	3,500
Mica	1	--	--	--	--

See footnotes at end of table.

Table 1.—United Kingdom: Production of mineral commodities[1] —Continued

(Thousand metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
NONMETALS —Continued					
Nitrogen: N content of ammonia	1,348	1,631	1,600	1,666	1,633
Potash, K_2O equivalent	[r]46	81	150	264	280
Refractory products:[6]					
Brick	809	768	639	690	NA
Cement	64	61	54	65	NA
Other	457	452	460	447	NA
Salt:					
Rock	611	905	1,311	1,590	1,600
Brine (in brine for purposes other than saltmaking)	1,918	1,871	1,760	1,915	[e]2,000
Other	5,477	5,426	4,239	4,315	[e]3,000
Sodium compounds: Sodium carbonate[e]	1,400	1,500	1,600	1,400	[e]1,360
Stone, sand and gravel:					
Chert and flint	322	39	52	47	NA
Igneous rock	37,215	35,613	32,250	36,178	NA
Limestone and dolomite	89,364	85,992	88,819	92,069	NA
Sandstone including ganister	13,522	11,755	13,407	13,544	NA
Slate	295	1,824	945	513	NA
Crushed rock, not further described	NA	NA	98,721	102,991	NA
Sand and gravel:					
Common sand and gravel	117,700	110,063	110,200	111,500	NA
Special sands	5,678	3,288	6,224	5,829	NA
Strontium minerals —tons	5,400	5,100	4,300	6,000	[e]5,000
Sulfur, byproduct:					
Of metallurgy —do	37	61	52	50	[e]50
Of spent oxides —do	6	5	5	5	[e]6
Unspecified —do	[r]77	[r]60	70	70	[e]70
Total —do	[r]120	[r]126	127	125	[e]126
Talc, soapstone, pyrophyllite —do	14,800	15,000	18,000	16,600	[e]18,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	214	193	199	200	[e]200
Coal:					
Anthracite	2,363	2,529	2,952	3,030	3,000
Bituminous	119,845	118,145	118,743	117,607	125,000
Other	1,592	1,426	1,882	1,732	2,140
Total	123,800	122,100	123,577	122,369	130,140
Coke:					
Metallurgical	15,754	11,518	9,879	10,189	NA
Breeze, all types	1,164	1,070	972	933	NA
Fuel briquets, all grades	NA	2,679	2,597	2,389	NA
Gas:					
Manufactured[7] —million therms	NA	33	42	25	NA
Natural:					
Gross —million cubic feet	NA	1,560,124	1,548,859	1,675,673	[e]1,600,000
Marketed —do	1,316,358	1,416,041	1,382,315	1,410,285	1,351,670
Natural gas liquids —thousand 42-gallon barrels	5,721	4,489	3,050	3,468	[e]3,500
Petroleum:					
Crude including field condensate —do	84,655	278,838	388,538	561,656	587,903
Refinery products:					
Gasoline:					
Aviation —do	2,127	425	329	570	534
Motor —do	129,472	149,721	155,950	136,374	140,667
Jet fuel —do	33,304	33,904	38,872	42,584	41,632
Kerosine —do	19,050	20,592	20,166	20,995	15,764
Distillate fuel oil —do	180,517	141,468	175,219	189,850	165,261
Residual fuel oil —do	217,749	152,133	203,250	190,476	157,842
Lubricants —do	9,170	7,319	8,412	9,310	8,750
Other —do	82,987	81,454	75,506	89,225	61,885
Refinery fuel and losses —do	48,737	50,939	48,178	45,766	44,219
Total —do	723,113	637,955	725,882	725,150	636,554

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Sept. 21, 1981.

[2]Includes wheels, centers, tires, axles, and semimanufactures for immediate sale.

[3]From imported bullion, including Pb content of alloys produced.

[4]From scrap materials. Series revised to comprise all secondary output including Pb content of secondary antimonial lead and to exclude output from domestic ores.

[5]Excludes plasters.

[6]Consists of brick, retorts, molds, and other refractory products made from clays, silica, silicious materials, magnesite, alumina, and chrome materials.

[7]Gas made at gasworks plus purchased coke oven refinery gas.

TRADE

Trade in minerals and metals for the 2 latest years available is given in table 2 and table 3.

Table 2.—United Kingdom: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	466	1,409	NA	NA.
Oxide and hydroxide	36,061	33,562	1,424	Republic of South Africa 4,111; Ireland 2,879; Norway 2,668.
Metal including alloys:				
Scrap	12,706	28,218	NA	West Germany 11,655; Netherlands 4,720; France 4,575.
Unwrought	160,515	206,985	6,747	Netherlands 82,200; West Germany 40,837; Italy 12,956.
Semimanufactures	63,227	73,928	4,748	West Germany 10,338; Ireland 8,555; France 5,837.
Antimony metal	498	173	NA	NA.
Arsenic trioxide, pentoxide, acids	2,949	3,101	NA	NA.
Beryllium metal including alloys, all forms	7	4	NA	NA.
Bismuth metal including alloys, all forms	402	255	NA	NA.
Cadmium metal including alloys, all forms	155	73	NA	NA.
Chromium:				
Chromite	38	222	NA	NA.
Oxide and hydroxide	4,638	3,726	2,267	France 761; West Germany 160; Canada 125.
Metal including alloys, all forms	2,246	2,121	NA	NA.
Cobalt:				
Oxide and hydroxide	411	244	NA	Netherlands 55; West Germany 51; Japan 36.
Metal including matte, speiss, etc	855	962	NA	NA.
Columbium and tantalum: Tantalum metal including alloys, all forms	36	43	NA	NA.
Copper:				
Ore and concentrate	973	--		
Matte and cement	--	6	NA	NA.
Metal including alloy:				
Scrap	40,476	59,732	NA	West Germany 27,322; Italy 19,434; Belgium-Luxembourg 6,923.
Unwrought	39,873	48,080	821	West Germany 15,853; Sweden 8,178; Italy 7,826.
Semimanufactures	131,921	118,907	6,895	Switzerland 15,988; Ireland 11,978; Spain 5,244.
Gold, unworked or partly worked:				
Bullion, refined thousand troy ounces	r20,595	15,823	NA	NA.
Metal troy ounces	446,895	167,184	NA	Iran 45,011; Ireland 25,721; Sweden 12,860.
Waste and sweepings value, thousands	$56,116	$106,441	NA	Spain $102,668.
Iron and steel:				
Ore and concentrate except roasted pyrite	384	898	NA	NA.
Metal:				
Scrap thousand tons	1,565	1,335	--	Spain 644; West Germany 194; Denmark 188; Italy 118.
Pig iron, cast iron, spiegeleisen	33,753	22,536	NA	Netherlands 7,570; Belgium-Luxembourg 7,093.
Sponge iron, powder, shot	21,002	22,098	NA	West Germany 6,196; Sweden 2,427; Netherlands 2,171.
Ferroalloys:				
Ferromanganese	1,959	6,964	NA	Canada 5,042.
Ferrosilicon	1,948	1,782	NA	NA.
Other ferroalloys	17,295	18,656	NA	West Germany 4,164; Sweden 1,686; Italy 1,342.
Steel, primary forms	400,066	482,649	59,595	Italy 132,023; Canada 54,646; West Germany 53,575.
Semimanufactures:				
Bars, rods, angles, shapes, sections:				
Wire rod thousand tons	477	451	10	West Germany 53; Venezuela 32; Belgium-Luxembourg 26.
Other bars and rods do	845	932	101	China, mainland 128; West Germany 104; Ireland 60.
Angles, shapes, sections do	479	588	104	India 169; Ireland 60; Canada 42.
Universals, plates, sheets:				
Tinned plates and sheets do	227	244	NA	India 40; Greece 25; New Zealand 15; France 14.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures —Continued				
Universals, plates, sheets — Continued				
Other____ thousand tons__	948	1,012	16	India 148; West Germany 143; Ireland 98; U.S.S.R. 57.
Hoop and strip_____do____	128	135	5	Ireland 19; U.S.S.R. 16; France 9; Italy 9.
Rails and accessories ___do____	96	105	9	Pakistan 18; Tanzania 12; Kenya 9; Sri Lanka 5.
Wire_____do____	71	117	19	Canada 18; China, mainland 9; Ireland 8.
Tubes, pipes, fittings ___do____	541	491	29	Ireland 39; Sweden 38; Netherlands 37; Denmark 28.
Castings and forgings, rough do____	95	112	49	Sweden 15; France 4.
Total _____do____	3,907	4,187		
Lead:				
Ore and concentrate_____	6,860	5,187	__	Belgium-Luxembourg 4,127.
Oxides _____	6,950	5,860	__	Ireland 2,125; Egypt 800; Sweden 672.
Metal including alloys:				
Scrap _____	16,615	32,369	__	West Germany 12,905; Italy 8,359; Denmark 4,265.
Unwrought _____	122,126	136,549	1,264	West Germany 34,165; Netherlands 17,803; Belgium-Luxembourg 13,362.
Semimanufactures _____	2,292	5,223	__	Belgium-Luxembourg 1,856; Ireland 630; Iraq 401.
Magnesium metal including alloys:				
Scrap_____	330	272	NA	NA.
Unwrought _____	1,009	1,075	284	France 306; Canada 257; West Germany 109.
Semimanufactures_____	814	704	__	Belgium-Luxembourg 126; West Germany 113; Ireland 97.
Manganese:				
Ore and concentrate_____	7,169	4,043	__	Republic of South Africa 1,415; Italy 452; West Germany 161.
Oxides _____	1,011	1,165	NA	NA.
Metal including alloys, all forms _____	424	362	NA	NA.
Mercury _____ 76-pound flasks__	1,479	3,974	NA	NA.
Molybdenum:				
Oxides and hydroxides _____	553	381	NA	NA.
Metal including alloys, all forms _____	147	332	52	Netherlands 89; West Germany 84; Sweden 22.
Nickel:				
Matte, speiss, similar materials _____	265	1,383	__	Belgium-Luxembourg 758; Norway 542.
Oxide_____	220	252	NA	NA.
Metal including alloys:				
Scrap _____	3,423	4,341	512	Sweden 1,304; West Germany 894; Japan 491.
Unwrought _____	20,412	14,866	__	West Germany 3,880; Belgium-Luxembourg 2,597; Sweden 1,660.
Semimanufactures _____	10,070	13,098	2,467	France 1,930; West Germany 1,368; Italy 774; Japan 749.
Platinum-group metals and silver:				
Ore and concentrate_ value, thousands__	r$9,137	$8,629	$513	Canada $8,115.
Waste and sweepings _____do____	r$25,919	$25,440	__	West Germany $9,698; Spain $6,263; Netherlands $2,578.
Metal including alloys:				
Platinum-group thousand troy ounces__	1,286	3,537	322	Italy 579; West Germany 257.
Silver:				
Refined, semimanufactures do____	15,207	18,229	NA	Switzerland 6,044; Italy 3,054.
Refined, unwrought____do____	39,545	35,398	9,484	France 10,642; Switzerland 7,973.
Other _____do____	675	2,926	NA	NA.
Tin:				
Ore and concentrate_____	3,608	4,019	__	West Germany 1,925; Spain 1,175; Belgium-Luxembourg 557.
Oxides _____	r513	453	NA	NA.
Metal including alloys:				
Scrap _____	153	22	NA	NA.
Unwrought _____	8,500	7,458	760	U.S.S.R. 2,148; West Germany 674; Netherlands 552; Czechoslovakia 457.
Semimanufactures _____	350	352	NA	West Germany 59; Norway 53; Italy 42.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Titanium oxides	12,763	18,705	1,716	France 2,694; Hungary 1,820; Netherlands 1,449; Ireland 1,270.
Tungsten:				
Ore and concentrate	135	30	--	West Germany 10.
Metal including alloys, all forms	358	227	--	West Germany 76; Netherlands 43; Italy 15.
Oxides	195	5	NA	NA.
Uranium and thorium metals including alloys, all forms	7	11	NA	NA.
Zinc:				
Ore and concentrate	9,443			
Oxide and peroxide	11,585	10,267	--	Netherlands 1,492; Belgium-Luxembourg 1,251; Ireland 884.
Metal including alloys:				
Scrap	6,018	4,818	--	West Germany 2,867; Belgium-Luxembourg 882.
Blue powder	2,732	2,210	--	Portugal 419.
Unwrought	21,162	19,119	--	Ireland 4,021; France 3,951; Belgium-Luxembourg 2,443.
Semimanufactures	r3,078	3,737	--	Pakistan 557.
Other:				
Ore and concentrate:				
Of molybdenum, tantalum, titanium, vanadium, zirconium	7,690	7,565	--	West Germany 1,190; Austria 976; Spain 697.
Of base metals, n.e.s	--	396	347	NA.
Ash and residue containing nonferrous metals	49,042	49,272	171	West Germany 24,832; Belgium-Luxembourg 8,648; Canada 3,639.
Oxides, hydroxides, peroxides of metals, n.e.s	r1,599	2,019	NA	NA.
Metals:				
Metalloids, n.e.s	4,787	2,589	--	Malaysia 615; China, mainland 421; Australia 396; Netherlands 162.
Alkali, alkaline-earth, rare-earth metals	238	222	NA	NA.
Pyrophoric alloys	3,829	7,574	--	West Germany 2,792; Ireland 2,487; Denmark 147.
Base metals including alloys, all forms, n.e.s	r35	115	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, corundum, etc	2,763	2,262	NA	NA.
Dust and powder of precious and semi-precious stones value, thousands	r$10,647	$7,805	$874	Belgium-Luxembourg $1,337; Switzerland $1,180; West Germany $1,105.
Grinding and polishing wheels and stones	7,826	7,369	--	West Germany 1,006; Sweden 740; Poland 624; Italy 546.
Asbestos, crude and waste	522	615	NA	NA.
Barite and witherite	3,424	4,622	NA	NA.
Boric acid and oxide	1,280	996	NA	Netherlands 799.
Cement thousand tons	1,879	1,600	697	Nigeria 496; Venezuela 163; Ireland 94; Togo 55.
Chalk	60,455	60,276	NA	Sweden 11,244; Australia 8,305; Nigeria 7,959.
Clays and clay products:				
Crude thousand tons	2,767	3,111	72	West Germany 503; Italy 468; Finland 406; Sweden 293.
Products:				
Refractory including nonclay brick do	217	253	--	Italy 27; Sweden 22; Brazil 20; West Germany 18.
Nonrefractory do	198	192	13	Ireland 46; Netherlands 20; France 15.
Cryolite and chiolite	15	7	NA	NA.
Diamond, all grades value, millions	r$4,827	$5,835	$580	Switzerland $3,206; Belgium-Luxembourg $1,472.
Diatomite and other infusorial earth	859	1,098	NA	NA.
Feldspar and fluorspar	9,925	28,483	NA	Norway 9,354; West Germany 9,319; Netherlands 6,219.
Fertilizer materials:				
Crude:				
Nitrogenous	123	230	NA	NA.
Phosphatic	35	222	NA	NA.
Potassic	10	6	NA	NA.
Other	3,454	2,603	NA	NA.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Manufactured:				
Nitrogenous	136,054	148,141	NA	Netherlands 15,099; Ireland 10,172.
Phosphatic	58,184	41,757	NA	Ireland 25,708; Bangladesh 12,066.
Potassic	63,274	164,740	NA	Norway 51,035; Netherlands 32,147; Sweden 27,663; Belgium-Luxembourg 23,930.
Other including mixed	520,530	435,267	NA	Ireland 231,273; West Germany 83,120; Pakistan 42,410.
Graphite, natural	2,648	3,158	1,554	NA.
Gypsum and plasters	r16,470	17,588	NA	Ireland 3,354; Saudi Arabia 1,734.
Lime	40,547	42,365	NA	Venezuela 18,252; Nigeria 5,404.
Magnesite	52,736	65,004	NA	West Germany 14,132; Poland 8,717; France 7,502.
Mica:				
Crude including splittings and waste	3,349	4,878	NA	West Germany 749.
Worked including agglomerated splittings	244	417	3	India 53.
Pigments, mineral: Iron oxides, processed	11,721	9,400	1,116	Italy 827; Australia 556; France 541; Netherlands 392.
Precious and semiprecious stone except diamond:				
Natural value, thousands	r$66,689	$90,588	$7,653	Switzerland $40,540; West Germany $10,600; France $9,363.
Manufactured do	r$447	$246	NA	NA.
Salt	r405,086	424,187	NA	Nigeria 142,903; Sweden 106,187; Ireland 59,959.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	r109,651	54,835	NA	China, mainland 8,439; Ireland 5,646; Nigeria 3,952.
Caustic potash including sodic and potassic peroxides	285	1,588	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	10,411	11,077	NA	NA.
Worked	4,015	5,936	NA	Ireland 517.
Dolomite, chiefly refractory grade	12,079	27,267	NA	Sweden 14,330.
Gravel and crushed rock thousand tons	5,835	6,437	NA	Belgium-Luxembourg 2,640; Netherlands 1,608; France 1,293.
Limestone except dimension	356,267	867,742	NA	Belgium-Luxembourg 244,603; West Germany 207,923; Norway 202,711.
Quartz and quartzite	12,876	317	NA	NA.
Sand excluding metal-bearing	78,123	85,525	NA	Ireland 36,198.
Sulfur:				
Elemental:				
Other than colloidal	1,422	1,344	NA	NA.
Colloidal	123	247	NA	NA.
Sulfur dioxide	r136	104	NA	NA.
Sulfuric acid	159,741	172,556	9,263	Ireland 63,297; Spain 31,117; Italy 18,357.
Talc, steatite, soapstone, pyrophyllite	3,978	5,605	--	Ireland 1,428.
Other nonmetals, n.e.s.:				
Crude	501,489	50,480	--	Netherlands 25,099; West Germany 8,146; Sweden 1,988.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	126,826	97,677	--	West Germany 83,243.
Slag and ash, n.e.s	4,674	4,493	--	Sweden 1,165.
Oxides and hydroxides of magnesium, strontium, barium	570	250	NA	NA.
Halogens, other than chlorine	1,958	1,824	NA	France 905; Ireland 264.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	94,345	77,011	602	Ireland 21,482; Belgium-Luxembourg 4,646; Saudi Arabia 4,567.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4,294	3,815	NA	NA.
Carbon black	35,235	48,527	NA	Ireland 7,282; Nigeria 5,892; West Germany 4,817.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	2,266	2,339	NA	France 750; West Germany 605; Ireland 219.
Briquets of anthracite and bituminous coal do	146	174	NA	Norway 166.
Lignite and lignite briquets	98	5	NA	NA.
Coke and semicoke	r904,248	720,578	NA	Norway 223,837; Sweden 165,324; Netherlands 121,823.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Hydrogen and rare gases	7,588	7,091	NA	Ireland 5,086; Netherlands 338; Norway 234; France 200.
Peat including peat briquets and litter	2,841	4,542	NA	NA.
Petroleum:				
Crude and partly refined:				
Crude thousand 42-gallon barrels	r168,427	282,359	51,504	West Germany 71,149; Netherlands 50,766; Sweden 30,592; Denmark 21,976.
Partly refined do	(1)	(1)		
Refinery products:				
Gasoline including natural do	18,453	18,039	370	Ireland 5,582; Netherlands 5,168; Belgium-Luxembourg 2,234.
Kerosine and jet fuel do	6,301	6,382	217	Ireland 1,696; Sweden 1,130; Denmark 613.
Distillate fuel oil do	37,260	39,958	159	Denmark 8,956; Netherlands 6,626; Sweden 6,320.
Residual fuel oil do	25,776	23,757	684	Ireland 6,495; Sweden 5,429; Netherlands 4,859; France 1,674.
Lubricants do	8,601	7,455	93	France 2,295; West Germany 527; Ireland 496.
Other:				
Liquefied petroleum gas do	8,661	10,245	--	Portugal 1,766; Netherlands 1,709; Norway 1,662; Spain 1,473.
Mineral jelly and wax do	356	328	9	West Germany 65; Nigeria 28; Netherlands 25.
Bitumen and other residues and bituminous mixtures, n.e.s. do	r930	1,080	--	Ireland 727; Saudi Arabia 22.
Pitch, pitch coke, petroleum coke do	r2,048	2,423	(2)	Norway 262; Sweden 68; France 68; Spain 38.
Total do	r108,386	109,667		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r395,336	302,544	30,960	Netherlands 68,098; Norway 58,744; Sweden 44,566; France 31,169.

rRevised. NA Not available.
[1]Included with residual fuel oil.
[2]Less than 1/2 unit.

Table 3.—United Kingdom: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	321,381	283,749	NA	Ghana 169,765; Greece 32,264; Switzerland 19,997.
Oxide and hydroxide	699,455	609,833	1,156	Jamaica 391,940; Suriname 115,583; Guyana 35,766.
Metal including alloys:				
Scrap	4,977	6,282	2,322	Ireland 1,375.
Unwrought	190,885	185,481	NA	NA.
Semimanufactures	164,074	188,794	19,998	West Germany 49,862; Belgium-Luxembourg 17,933; France 17,325.
Arsenic trioxide, pentoxide, acids	196	87	NA	NA.
Beryllium metal including alloys, all forms	10	11	8	NA.
Bismuth metal including alloys, all forms	325	335	NA	NA.
Cadmium metal including alloys, all forms	1,174	1,423	NA	NA.
Chromium:				
Chromite	138,152	92,041	NA	Republic of South Africa 63,247; Philippines 13,046.
Oxide and hydroxide	1,033	2,054	NA	Netherlands 512; West Germany 503; U.S.S.R. 500.
Metal including alloys, all forms	222	[1]55	NA	NA.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Cobalt:				
Oxide and hydroxide	1,141	683	48	Canada 507; Belgium-Luxembourg 75.
Metal including alloys, all forms	2,267	3,031	NA	NA.
Columbium and tantalum: Tantalum metal including alloys, all forms	106	75	42	West Germany 19; Belgium-Luxembourg 9.
Copper:				
Ore and concentrate	548	563	NA	NA.
Matte	1,448	--		
Metal including alloys:				
Scrap	9,592	10,546	1,438	Ireland 1,947; Italy 506; West Germany 344.
Unwrought	405,000	377,777	6,554	Chile 92,835; Zambia 66,065; Canada 54,822; Peru 44,329.
Semimanufactures	67,067	103,602	8,219	West Germany 22,805; France 20,451.
Gold, unworked or partly worked:				
Bullion thousand troy ounces	16,434	25,258	NA	NA.
Metal troy ounces	263,636	768,402	90,022	Kuwait 138,248; West Germany 128,603; Singapore 93,237.
Waste and sweepings value, thousands	$55,790	$265,071	$191,332	Canada $43,317; Kuwait $7,232.
Iron and steel:				
Ore and concentrate except roasted pyrite thousand tons	15,453	17,841	NA	Canada 6,054; Brazil 3,957; Norway 1,766; Republic of South Africa 1,654.
Roasted pyrite do	227	221	NA	Sweden 154; Ireland 34.
Metal:				
Scrap do	458	35	2	Ireland 11; Denmark 7; West Germany 6.
Pig iron, cast iron, spiegeleisen do	131	132	NA	Norway 52; West Germany 41; Brazil 10.
Sponge iron, powder, shot do	38	41	NA	Venezuela 15; Sweden 13; West Germany 6.
Ferroalloys:				
Ferromanganese do	84	81	NA	Norway 32; Republic of South Africa 32.
Ferrosilicon do	95	115	NA	Norway 78; Spain 11; U.S.S.R. 3.
Other ferroalloys do	r105	140	NA	Republic of South Africa 34; Norway 33; Sweden 24.
Steel, primary forms do	803	869	(2)	West Germany 204; Belgium-Luxembourg 117; Sweden 75.
Semimanufactures:				
Bars, rods, angles, shapes, sections:				
Wire rods do	131	179	NA	West Germany 48; France 43; Netherlands 26.
Other bars and rods do	345	358	NA	Sweden 63; France 49; West Germany 44; Italy 41.
Angles, shapes, sections do	230	277	NA	Belgium-Luxembourg 82; Republic of South Africa 46; Spain 29.
Universals, plates, sheets:				
Tinned plates and sheets do	112	129	12	Netherlands 68; Norway 15; West Germany 14.
Other do	1,698	1,538	NA	West Germany 289; Belgium-Luxembourg 251; France 134.
Hoop and strip do	91	102	2	West Germany 43; Belgium-Luxembourg 17; France 16.
Rails and accessories do	25	15	NA	West Germany 8; France 5.
Wire do	47	51	(2)	Belgium-Luxembourg 18; West Germany 11; Sweden 6.
Tubes, pipes, fittings do	267	330	3	Italy 66; West Germany 62; Netherlands 40; Austria 26.
Casting and forgings, rough do	20	19	(2)	France 6; West Germany 4.
Total do	2,966	2,998		

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Lead:				
Ore and concentrate	42,932	67,812	NA	Australia 37,620; Canada 12,718; Peru 6,488.
Oxides	371	793	NA	France 520.
Metal including alloys:				
Scrap	2,618	9,081	813	Kuwait 2,048; Canada 1,383; U.S.S.R. 513.
Unwrought	198,998	205,204	NA	Austria 162,715; Canada 35,515.
Semimanufactures	1,834	2,304	NA	Ireland 1,309; Netherlands 218.
Magnesium metal including alloys:				
Scrap	389	270	NA	NA.
Unwrought	5,283	5,910	NA	Norway 2,991; Netherlands 1,498; Canada 961.
Semimanufactures	440	301	NA	NA.
Manganese:				
Ore and concentrate	261,238	544,220	NA	Republic of South Africa 305,214; Brazil 174,837.
Oxides	5,955	5,900	NA	Ireland 2,101; Greece 1,689; Belgium-Luxembourg 1,606.
Metal including alloys, all forms	2,824	3,071	NA	NA.
Mercury 76-pound flasks	12,270	8,877	NA	Netherlands 4,090; Spain 3,133.
Molybdenum:				
Ore and concentrate	11,383	15,285	NA	NA.
Metal including alloys, all forms	220	274	59	Austria 102; West Germany 40; France 27.
Nickel:				
Ore and concentrate	17	36	NA	NA.
Matte, speiss, similar materials	31,693	27,822	NA	Canada 21,886; Guatemala 2,914; Australia 2,130.
Metal including alloys:				
Scrap	2,854	3,078	838	Netherlands 420; France 373; West Germany 271.
Unwrought	16,807	17,960	623	Canada 6,023; Norway 2,969; Australia 2,808.
Semimanufactures	3,199	4,680	1,612	West Germany 1,656; Canada 531; Sweden 185.
Platinum-group metals and silver:				
Ore and concentrate value, thousands	r$157,798	$202,265	NA	NA.
Waste and sweepings do.	r$89,430	$244,461	NA	NA.
Metals including alloys:				
Platinum group thousand troy ounces	386	386	64	Republic of South Africa 193; France 64; Belgium-Luxembourg 32.
Silver:				
Refined do.	4,630	3,794	643	France 1,511; West Germany 547; India 354.
Unrefined do.	129	193	NA	NA.
Other do.	41,989	35,430	2,347	East Germany 6,848; India 3,665; Australia 3,215.
Tin:				
Ore and concentrate	39,105	35,987	NA	Bolivia 31,607; Argentina 1,681.
Metal including alloys:				
Scrap	1,355	1,314	413	France 119; Hong Kong 114; West Germany 85.
Unwrought and semimanufactures	8,475	8,600	380	Nigeria 2,407; Netherlands 1,743; Malaysia 1,645.
Titanium:				
Ore and concentrate	306,707	382,990	NA	NA.
Oxides	6,296	9,846	2,675	West Germany 2,018; Italy 1,636; Belgium-Luxembourg 941.
Metal including alloys, all forms	7,976	[3]1,184	NA	NA.
Tungsten:				
Ore and concentrate	3,653	2,997	76	Portugal 813; Netherlands 619; West Germany 359; China, mainland 233.
Metal including alloys, all forms	567	245	38	Republic of Korea 52; West Germany 50; Austria 32.
Uranium and thorium:				
Ore and concentrate	40	943	NA	NA.
Metals including alloys, all forms	5	1	NA	NA.
Zinc:				
Ore and concentrate	160,201	182,067	11,298	Australia 52,191; Peru 43,338; Ireland 34,315; Canada 21,539.
Oxide and peroxide	3,649	4,244	NA	West Germany 1,914; France 1,390.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc —Continued				
Metal including alloys:				
Scrap and blue powder	1,036	1,431	NA	NA.
Unwrought	188,765	178,144	NA	Canada 45,673; Netherlands 44,133; Finland 36,618.
Semimanufactures	1,243	1,003	NA	West Germany 974.
Zirconium:				
Ore and concentrate	43,015	33,667	NA	NA.
Metal including alloys, all forms	150	228	NA	NA.
Other:				
Ores and concentrates of columbium, tantalum, and vanadium	466	621	NA	NA.
Ash and residue containing non-ferrous metals	66,259	96,099	11,660	West Germany 9,036; Netherlands 4,519; Spain 1,147.
Oxides, hydroxides, peroxides	326,826	294,378	NA	U.S.S.R. 56,088; West Germany 37,457; Finland 1,088.
Metals:				
Alkali, alkaline-earth, rare-earth metals	169	1,101	NA	France 672; West Germany 342.
Pyrophoric alloys	3,411	3,651	NA	Ireland 3,464.
Base metals including alloys, all forms, n.e.s. value, thousands	r$7,699	$14,452	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Pumice, emery, corundum, etc. do	$8,716	$11,158	NA	NA.
Dust and powder of precious and semiprecious stones do	r$20,491	$25,824	NA	NA.
Grinding and polishing wheels and stones	3,841	3,994	142	Italy 857; Netherlands 739; Austria 449.
Asbestos	117,781	116,665	NA	Canada 96,741; Republic of South Africa 9,222.
Barite and witherite	80,530	90,355	NA	Netherlands 30,780; Ireland 22,257; Morocco 20,699.
Boron materials:				
Borates and perborates	10,993	10,409	2,767	Netherlands 5,871; West Germany 831.
Oxide and acid	7,554	8,525	NA	France 5,032; Turkey 2,224; Netherlands 1,089.
Bromine	4,006	4,168	NA	NA.
Cement	107,123	146,855	2,020	Ireland 133,653; France 4,698.
Chalk	970	1,547	NA	NA.
Clays and clay products:				
Crude	186,155	195,738	83,230	France 27,049; Republic of South Africa 24,903; Spain 19,498.
Products:				
Refractory including nonclay bricks	52,095	60,332	2,812	Ireland 19,153; West Germany 11,111; Denmark 7,189.
Nonrefractory	61,113	84,395	NA	Italy 52,103; West Germany 7,792; Spain 7,497.
Cryolite and chiolite	2,817	2,184	--	All from Denmark.
Diamond, all grades value, millions	r$4,609	$5,551	NA	NA.
Diatomite and other infusorial earth	9,090	11,902	5,824	Denmark 2,283; France 2,246.
Feldspar and fluorspar	171,734	193,476	NA	Norway 103,097; Finland 29,651.
Fertilizer materials:				
Crude:				
Nitrogenous	8,289	7,979	NA	Chile 5,737.
Phosphatic thousand tons	1,772	1,752	NA	Morocco 832; Senegal 384.
Potassic	r23,569	37,626	NA	West Germany 21,830; East Germany 14,831.
Manufactured:				
Nitrogenous	416,007	506,616	NA	Netherlands 62,785; Belgium-Luxembourg 37,251; France 11,811.
Phosphatic:				
Thomas (basic) slag	9,192	12,829	NA	Belgium-Luxembourg 12,725.
Other	r70,666	80,153	NA	Tunisia 14,876; Portugal 12,663; Netherlands 11,978.
Potassic	668,179	629,662	NA	East Germany 231,362; West Germany 188,874.
Other including mixed	285,649	361,388	NA	Netherlands 162,688; Belgium-Luxembourg 76,538; Italy 24,104.
Graphite, natural	17,166	14,584	NA	Norway 7,347; Madagascar 3,123; Sri Lanka 1,164.
Gypsum and plasters	40,240	38,907	NA	Ireland 28,554; West Germany 3,925.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Iodine	1,315	1,359	NA	NA.
Lime	2,723	2,740	NA	NA.
Magnesite	131,616	145,266	NA	Greece 50,957; Spain 29,790; Italy 22,034.
Mica:				
Crude including splittings and waste	15,337	17,918	118	China, mainland 6,110; Spain 3,962; France 1,396.
Worked including agglomerated splittings	436	545	NA	West Germany 145; Belgium-Luxembourg 140; France 64.
Pigments, mineral:				
Natural, crude	3,317	3,309	NA	NA.
Iron oxides, processed	24,906	24,926	924	West Germany 20,013.
Precious and semiprecious stones except diamond:				
Natural value, thousands	r$73,198	$103,169	$7,283	Switzerland $46,344; West Germany $11,289.
Manufactured do	r$568	$1,235	$465	NA.
Pyrite, gross weight	(4)	(4)		
Salt and brine	235,753	748,017	NA	Italy 478,400; West Germany 122,765; Netherlands 69,597.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	r29,667	47,552	NA	West Germany 32,976; France 4,204; Belgium-Luxembourg 2,772.
Caustic potash including sodic and potassic peroxides	3,608	3,212	NA	France 1,421.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	12,604	9,083	NA	Italy 8,292.
Slate	718	422	NA	NA.
Other	16,179	18,019	NA	Sweden 6,878; Republic of South Africa 2,683.
Worked:				
Slate	2,544	3,988	NA	France 1,845; Italy 1,515.
Paving and flagstone	14,775	12,310	NA	Portugal 11,372.
Other	14,497	18,945	NA	Italy 11,747; India 1,978; Portugal 1,679.
Dolomite, chiefly refractory grade	95,209	80,155	NA	Spain 61,224; Norway 13,566.
Gravel and crushed rock	148,849	169,558	NA	Italy 23,631; Norway 17,556.
Limestone except dimension	3,141	3,522	NA	NA.
Quartz and quartzite	3,865	4,377	602	NA.
Sand excluding metal-bearing	83,423	82,287	1,531	Belgium-Luxembourg 64,763.
Sulfur:				
Elemental:				
Colloidal	561	491	NA	NA.
Other than colloidal thousand tons	41,134	41,194	NA	Poland 395; France 391; Canada 152; Belgium-Luxembourg 138.
Sulfuric acid	65,797	30,941	NA	Norway 28,535.
Talc, steatite, soapstone, pyrophyllite	62,473	65,757	NA	Norway 15,309; China, mainland 10,738; France 9,492.
Vermiculite	134,228	148,396	NA	NA.
Other:				
Crude	269,113	365,043	NA	NA.
Slag, dross, and similar waste, not metal-bearing:				
From iron and steel manufacture	95,643	62,668	NA	Canada 23,046; Republic of South Africa 22,196.
Slag and ash, n.e.s	8,212	6,734	NA	Netherlands 5,419.
Oxides and hydroxides of magnesium, strontium, barium	1,504	1,116	165	NA.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	49,133	65,053	NA	Belgium-Luxembourg 35,179; Ireland 11,125; France 10,932.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	17,889	12,257	2,038	Trinidad and Tobago 5,444.
Carbon black	71,127	76,335	2,581	Canada 34,467; France 10,731; Norway 9,925.
Coal and briquets:				
Anthracite and bituminous thousand tons	2,352	4,353	1,028	Australia 2,137; Poland 658; West Germany 209.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coal and briquets —Continued				
Briquets of anthracite and bituminous coal	77,144	91,988	NA	France 59,049; West Germany 31,859.
Lignite and lignite briquets	--	200	NA	NA.
Coke and semicoke including gas carbon	15,160	132,475	54,886	West Germany 43,186; Japan 27,500.
Hydrogen and rare gases	r2,091	1,337	NA	NA.
Peat including peat briquets and litter	157,895	160,076	NA	Ireland 139,983; Finland 5,187.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	r483,547	422,417	--	Saudi Arabia 110,305; Kuwait 76,896; Iraq 44,256.
Refinery products:				
Gasoline including natural do.	49,012	50,003	218	Netherlands 13,215; Italy 10,942; Belgium-Luxembourg 7,942.
Kerosine and jet fuel do.	5,069	4,900	NA	Netherlands 2,361; Italy 1,143; France 544.
Distillate fuel oil do.	12,744	8,719	NA	U.S.S.R. 3,084; Netherlands 2,526; Italy 983.
Residual fuel oil do.	27,092	40,246	NA	Netherlands 15,474; France 6,863; Belgium-Luxembourg 3,740.
Lubricants do.	11,954	13,312	552	Belgium-Luxembourg 3,277; Netherlands 3,108; Denmark 2,248.
Other:				
Liquefied petroleum gas do.	41,971	79,378	NA	Norway 70,538; Belgium-Luxembourg 903.
Mineral jelly and wax do.	r275	302	14	Netherlands 220.
Bitumen and other residues and bituminous mixtures, n.e.s do.	r1,274	988	656	France 134; Sweden 83.
Pitch, pitch coke, petroleum coke do.	1,851	2,067	1,094	Netherlands 728.
Total do.	r151,242	199,915		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r336,301	512,725	219,725	Netherlands 158,852; France 74,565.

r Revised. NA Not available.

[1]Total does not include an unreported quantity valued at $2,259,500 imported in 1979.

[2]Less than 1/2 unit.

[3]Excludes quantity valued at $28,656 in 1979.

[4]Pyrite is reported as a part of total sulfur and unroasted pyrite and cannot be separated; however, official British sources indicate that the quantity of pyrite included is "very small."

COMMODITY REVIEW

METALS

Aluminum.—British Aluminium, Ltd. (BA), one of the United Kingdom's three largest aluminum producers, continued its expansion in its plant at Lochaber, Scotland, from 28,000 tons to 37,000 tons per year, with the new power to come from "existing resources." However, its major smelter at Invergordon, Scotland (100,000-ton-per-year capacity), which abandoned expansion plans in 1979 because of high electricity costs, was involved in a dispute with the North of Scotland Hydro Electric Board over contract charges; the disputed amounts were £19 million in 1979 and £30 million in 1980, and the dispute was expected to end up in the courts. BA's profit in the same 2 years dropped from £21 million to £12 million.

In common with the whole of British industry, Alcan Aluminium (U.K.) Ltd. suffered from a "grossly overvalued" pound sterling, as well as high interest rates and serious labor disputes, according to the chairman of the parent company, Alcan Aluminium Ltd. of Canada. The chairman also pointed out that another problem for the British aluminum industry was excess capacity at the rolling mill end, as at Alcan's (U.K.) Rogerstone plant, near Cardiff; he said the United Kingdom needed only one sheet mill, not three or four, as at present. Alcan for the time being had no

plans to expand capacity at its 120,000-ton-per-year smelter at Lynemouth, on the northeast coast.

The third British primary aluminum producer, Anglesey Aluminium Ltd. at Holyhead, Wales, had a capacity of 100,000 tons per year. No changes were planned.

The serious decline in the European market for rolled products also affected the profitability of the new rolling mill opened in 1978 by the Aluminum Co. of America at Swansea, Wales. The plant was, in addition, bedeviled by operating and technical problems to the extent that an operating loss of about £16 million was suffered in 1980.

Gold.—The Ogofau gold mine, at Pumpsaint, 30 miles north of Swansea, was being investigated by Anglo Dominion Gold Exploration Ltd., under an agreement with the holder of a prospecting license, Anglo Canadian Exploration Ltd. and its parent company, Quebec Sturgeon River Mines Ltd. The mine was worked extensively during Roman times and saw sporadic activity in the last, and earlier in the present, centuries.

Iron Ore.—BSC closed its Beckermet (Florence) Mine near Egremont, Cumbria, when it terminated operations at the Workington plant nearby, which used the ore. A plan was evolved by local interests, including former employees and the landowners, to reactivate the mine on a smaller scale because its high-grade ore would have value in special foundry uses, and even as specimens. The mine is reportedly the only working hematite mine in Western Europe.

Iron and Steel.—BSC recorded the highest loss ever by a British company when its results for the year ending in March 1980 were put at £545 million, compared with a loss of £309 million for the previous year. Over £200 million of the loss was attributed to a 13-week strike early in 1980. The new American chairman of BSC, Ian McGregor, warned in presenting the report that the outlook for steel was bleak and that further cuts in BSC operating costs would have to be made. In the year ending in March 1981, the loss was even larger, amounting to £668 million.

In September, the British Government announced that it had increased BSC's external financing limit for 1980 from the initial £450 million to £971 million. This amount, equivalent to the Treasury subsidy, was expected to exceed possibly £1,000 million by yearend, because BSC's losses continued at a rate of £15 million per week and orders for crude steel declined to 150,000 tons per week.

At yearend, the company unveiled a package of cutbacks and reductions in force to enable it to survive. A cut of 20,000 in the labor force was accompanied by a reduction in capacity from 15 million to 14.4 million tons per year. There were no plans to close a major integrated plant, but some half dozen large units, including rodmills, foundries, tin-plating works, and coke ovens, would be closed at plants in the Midlands and Wales. It was hoped thereby to increase steelmaking capacity utilization from 64% in October to 90% by the end of the financial year. Early in 1981, the Government sought legislative authority to wind up affairs of the company if the survival plan did not succeed.

Lead.—New and more stringent regulations governing exposure to lead at the working place were presented for Parliamentary approval in September. The new rules, which replace legislation largely dating back to before 1927, were to come into force on August 18, 1981. They cut the permissible lead content of the blood of exposed workers from 100 micrograms to 80 micrograms per 100 milliliters of blood.

Britannia Lead Co. Ltd., at Northfleet, Kent, on the Thames Estuary, suffered a 7-week strike in February and March, causing a loss of an estimated 20,000 tons of refined lead production. After 50 years of operation, the company was having trouble meeting the pressure to reduce emissions and was considering either modernization or replacement. No decision was reached on possible expansion of the 150,000-ton capacity, or relocation if a new plant is built. Britannia is a subsidiary of M.I.M. Holdings Ltd. and refines the output of the Mount Isa Mine in Australia; there is also a modern secondary lead refinery rated at 30,000 tons per year.

Nickel.—In June, Inco Europe Ltd. inaugurated a new roaster and sulfuric acid plant at its Clydach, Wales, refinery, built at a cost of over £10 million, enabling sulfide matte from Inco's new mines in Guatemala and Indonesia to be treated and raising Clydach's capacity from 100 million to 120 million pounds per year of nickel products. The nickel carbonyl plant, which began operation in 1902, had hitherto treated only roasted nickel concentrates from Canada; the new sulfide matte was to come from the smelting of the lateritic ores with gypsum at the mines. A 10-week strike of

Inco workers was settled early in 1980, but nevertheless Clydach was forced to cut production in August because of declining nickel sales.

Platinum.—Matthey Rustenburg Refiners Ltd. (MRL), a joint subsidiary of Johnson Matthey Co. Ltd. and Rustenburg Platinum Mines Ltd. of the Republic of South Africa, decided to construct a new £15 million refinery, using solvent extraction techniques, at the site of its existing refinery at Royston, Hertfordshire, north of London. Capacity figures were not released. MRL also operated a complementary refinery at Brimsdown, near Enfield, in north London, where in 1979 a multimillion-pound capital investment program was completed, as well as two refineries in the Republic of South Africa, one at the Rustenburg, Transvaal Mine, and the other at Wadeville, Transvaal.

Tin.—High tin prices early in the year stimulated a great deal of new activity in exploration and reexamination in the tin area of Cornwall. However, the price fell from about £8,000 to about £6,000 per ton from January to December, causing some rethinking. Production during 1980 increased by an estimated 25%, to well over 3,000 tons.

There were three large mining groups active during the year accounting for almost all the production, Carnon, St. Piran, and Geevor, as well as a number of smaller operations, mostly dredging or retreating tailings.

Carnon Consolidated Tin Mines Ltd., owned 95% by Rio Tinto Zinc Corp. (RTZ), brought Wheal Jane back into production in June; holing through to the adjacent Mount Wellington Mine, which RTZ acquired with Wheal Jane in 1979, was accomplished in September but production from Mount Wellington was due only in 1981. Both mines were being refurbished and modernized, as well as the surface plant at Wheal Jane. About 280,000 tons of ore per year, containing 0.84% tin, will be produced, resulting in concentrates containing about 1,500 tons of tin. Recovery of tin in the mill was expected to be about 70%, including 55% in the gravity concentrate and 15% in the flotation concentrate. About 500 tons of copper in concentrates will also be produced.

Geevor Tin Mines Ltd., at Pendeen, commissioned the subincline shaft to connect it with the neighboring Levant Mine, but dewatering of the latter was slow. In order to conserve cash resources, work was also delayed on Allen's shaft at Botallack, which was to be used for examination of the seaward lode extension. The mine pinned its long-term hopes on an eventual increase in the price of tin.

St. Piran, Ltd., which controlled the South Crofty and Wheal Pendarves Mines through subsidiaries, was the object of financial disputes among the stockholders. South Crofty was contemplating expansion of both mining and milling facilities, based on over 2 million tons of reserves, which would provide for at least 10 years of operation if the tin price was favorable. Additional reserves were expected to be encountered after current development is completed in the lowest levels of the mine.

A new company, South West Consolidated Mines Ltd., controlled by Dundonian Ltd., made a stock offering expected to provide £2.75 million to be used in exploration in the southwest. The first work was directed at several tin prospects at Callington and Gunnislake on the Devon-Cornwall border. Several main targets were identified: The old Redmoor Mine, Blogister's Plantation and Haye South, all near Callington, and an old mine working near Gunnislake.

Titanium.—Planning approval was obtained early in the year for construction of a new 5,000-ton-per-year titanium granules plant, to be built on a site at Shotwick, near Shotton, which BSC abandoned when it closed its Shotton plant. Partners in the project were the National Enterprise Board (NEB), Rolls Royce Ltd. and IMI Ltd. NEB and Rolls Royce were interested because of the need of a secure supply of titanium metal for aircraft engines; IMI was the sole U.K. producer at the moment, under contract with ICI Ltd., which was to close its Bains plant on Teesside for economic reasons. The new plant, with a target commissioning date of 1982, was to cost some £25 million and employ about 300 people.

Tungsten.—In June, Amax Exploration of U.K. Inc., with Hemerdon Mining and Smelting Ltd. (U.K.), brought the $2 million pilot plant onstream at the Hemerdon Ball deposit near Plymouth. Early in 1981, Amax completed its study of the commercial feasibility of a mine and mill complex on the site.

The study concluded that about 38 million tons carrying 0.18% tungsten and 0.029% tin were available for open pit mining. The results of the pilot plant testing showed that 64% of the tungsten could

be recovered in a 65% tungsten concentrate and 66% of the tin in a second concentrate containing 25% tin. Planning permission was to be sought from the authorities for a £44 million mine, to produce 6,000 tons of ore per day and employ 300 to 400 people by 1987. The mine should then be able to supply all the United Kingdom's needs for tungsten.

NONMETALS

Barite.—SPO Minerals Ltd., a new company, started construction of a plant at Brassington, in Derbyshire, an area of the South Pennines formerly famous for its lead mining. The company will not mine ore, but will treat 150,000 tons per year of old tailings from a 19-mile radius of the plant. There are estimated to be 0.7 million tons available with an average of 30% barite, 15.5% fluorspar, and 2.4% lead; a further 0.85 million tons was potentially available after exploration. The plant was to produce about 33,600 tons per year of barite for the North Sea drilling market, for which a price increase was expected in 1981. SPO also owned 5% of Carnon, the Cornish tin mine, controlled by RTZ, until selling it to RTZ early in 1981.

Fluorspar.—Swiss Aluminum Mining (U.K.) Ltd. cut back its work force and work time considerably and closed its Redburn Mine, as well as halting development at two other mines, leaving only the Stanhope Burn and Cambokeels Mines in operation, with a run-of-the-mine output of 10,000 or 11,000 tons per week of acid spar ore. Poor domestic demand and the strength of the pound sterling were given as the cause.

Gypsum.—British Gypsum Ltd., the only large producer of gypsum in the United Kingdom, was developing a mine at Barrow-upon-Soar, Leicestershire, for production by 1983. The reserves, about 6 miles south of the company's other mine at East Leake, were put at 30 million tons. Planning permission was received in August for the mine, but not for a gypsum wallboard plant that would have been constructed nearby.

Magnesia.—The bulk of the United Kingdom's industrial requirements was provided by the Hartlepool plant of the Steetley Co. Ltd., which had a capacity of 200,000 tons per year of seawater magnesia, including 25,000 tons of caustic calcined magnesia.

Mica.—The first British mica mine, not a byproduct producer, was organized as a joint venture of Sir Alfred McAlpine and Sons Ltd. and Microfine Minerals & Chemicals Ltd. The venture was to be located in the Pitlochry schist region of north-central Scotland. Mica was to be produced in the 10- to 100-mesh size, with a target of 5,000 tons per year; byproducts would include 2,000 tons per year of silica sand and 1,000 tons per year of almandine garnet.

Potash.—In September, Charter Consolidated Ltd. and the Anglo American Corp. Ltd. decided to cut back the scale of operations at the Boulby Mine, in the North York Moors National Park, near the coast, east of Middlesbrough, to 1.2 million tons of ore per year, equivalent to about 360,000 tons of product, versus an original goal of 1 million tons of product. This will enable employment at the mine to be reduced from 1,500 to 850 and will hopefully bring the mine to profitability, long after startup in 1974. Charter Consolidated, the operator, had felt reasonably optimistic as the year started, but felt later that the only alternative to reducing operations was a shutdown. Problems at the mine included difficult mining conditions, gas, and high insoluble content of the ore.

MINERAL FUELS

Coal.—Preliminary figures showed that coal production, at 130 million tons, increased almost 8 million tons in 1980, with a particularly notable increase in opencast production, to 15.8 million tons.

The public inquiry by the Department of the Industry into the feasibility of mining in the Vale of Belvoir Coalfield focused on the Government's energy plans, and how much coal was needed to supplement the newly announced and ambitious nuclear energy program; much less attention was paid to the environmental aspects of mining, on which the inquiry had previously focused. The Central Electricity Generating Board (CEGB) suggested a possible nuclear capacity of 37 gigawatts by the year 2000, along with the burning of 60 million tons of coal, compared with about 80 million tons at present. Each 2-gigawatt shortfall in nuclear energy would, however, require 5 million tons of coal annually. The CEGB, reacting cautiously, believed there might be very little fall, or none at all, in coal requirements. A growth of 2% to 3% per year was considered more likely, and this steady market, coupled with continued oil price increases, would lead to the cost of coal being only about 59% of that of oil by the year 2000. A substantial investment was also being planned in deepwater import

facilities capable of handling 10 million tons per year, particularly for those grades, like coking coal, that will be needed from abroad.

The largest new coal mine project, Selby in Yorkshire, proceeded on schedule during the year. This £850 million (as of June 1980) project will produce 10 million tons per year by the late 1980's. Six entries were being developed in the coalfield; five are vertical shafts (North Selby, Stillingfleet, Riccall, Whitemoor, and Wistow), which will be used for men and materials. The sixth (Gascoigne Wood) is an incline, where the entire production will be brought out on conveyors. First production, from the Wistow shaft area, will be in late 1982 or early 1983. The program has been kept reasonably well on schedule, although a flood occurred in June in the Wistow area; much of the mine area, south of the city of York, is below sea level at the surface.

The third major new project, in addition to the Vale of Belvoir and Selby, being considered by the National Coal Board, the Government entity that controls all coal mining, was the £200 million Park Mine in Staffordshire, where 100 million tons of coal was estimated to be available for planned extraction at a rate of 2.2 million tons per year. The project was under serious restudy because of the high chlorine content of the coal, which might make it unsuitable for power generation.

Natural Gas.—Gas reserves at the end of 1980 were estimated at 26 trillion (proven) to 76 trillion (probable) cubic feet. Including pipeline shipments from the U.K.-Norwegian Frigg Field, Britain's needs now can be entirely supplied from the North Sea and Morecambe Bay off the west coast. Development of a field in the latter area was planned, as was development of the Rough Gasfield in the southern North Sea Basin. Britain had at yearend a total of eight gasfields in production, in addition to minor production of associated gas from oilfields in the northern North Sea. Associated gas was also being reinjected into several oilfield reservoirs. A seabed gas-gathering pipeline was planned for the purpose of collecting associated gas from northern North Sea oilfields and gas deposits in that area. A 36-inch trunk line, fed by lateral lines, was proposed. No final announcements had yet been made as to ownership, point of landing, or price of the gas collected, but a line several hundred miles long roughly parallel to the Norwegian median line was contemplated. The gas might be landed, speculatively, at St. Fergus, Scotland.

Petroleum.—Britain was almost self-sufficient in petroleum production by the end of 1980, reaching a rate of 1.8 million barrels per day. Shortly after yearend there were 16 producing oilfields in the North Sea and a further 9 fields were being developed. Oil reserves were estimated at 16.3 billion barrels (proven) to 32.6 billion (probable) barrels, and a seventh round of offshore licenses was awarded in December.

Oil production was projected by the Department of Energy at 82 million to 110 million tons (1.7 million to 2.3 million barrels per day) in 1982 and 90 million to 120 million tons (1.8 million to 2.4 million barrels per day) in 1984. In the past such predictions have tended to over estimate future production because of the scale of the technological challenge in producing oil in the storm-prone North Sea from water depths of 300 to 600 feet, 100 miles from land, and because of frequent strikes by diverse groups ashore. Possible limiting factors in the future may be taxation and Government oil depletion policies.

In 1980, one field, Murchison, started production. Shortly after the year ended, the Tartan Field commenced production, and the roster of British oilfields was at that time as follows:

Field	Operator[1]	Approximate production rate (Million barrels per day)
Argyll	Hamilton Bros	20,000
Auk	Shell-ESSO	14,000
Beryl	Mobil	113,000
Brent	Shell-ESSO	201,000
Claymore	Occidental	90,000
South Cormorant.	Shell-ESSO	27,500
Dunlin	____do	103,700
Forties	British Petroleum	502,000
Heather	Unocal	21,000
Montrose	Amoco	35,000
Murchison	Conoco	85,000
Ninian	Chevron	300,500
Piper	Occidental	200,000
Statfjord	Conoco in the United Kingdom, Mobil in Norway.	[2]150,000
Tartan	Texaco	8,500
Thistle	British National Oil Corp.	136,000

[1]Operator only. Operator frequently has minor equity only. For example, Ninian's operator, Chevron, has less than 17% equity, while ICI Petroleum and the British National Oil Corp. each have much larger shares.
[2]15.9% of reserves are in the United Kingdom; the remainder in Norway.

A further eight fields were currently under development, as cited in the following tabulation:

Field	Operator	Estimated production startup
Beatrice	British National Oil Corp.	1981
Beryl B	Mobil	1984
Brae	Marathon	1983
North Cormorant	Shell-ESSO	1982
Fulmar	do	1982
Hutton	Conoco	1984
N. W. Hutton	Amoco	1982
Magnus	British Petroleum	1983
Maureen	Phillips	1983

At midyear, Energy Secretary David Howell said the Government would "take (oilfield development) decisions on a case-by-case basis, but give greater emphasis to the need to limit the sharpness of the peak in production.... In particular, the Government will consider delaying the development of fields discovered after the end of 1975, which are not covered by (previously given) assurances.... The Government will also continue to tighten controls on gas flaring." He also said "there can...be no rigid plan" for oil production controls.

After this announcement, permission for development of at least one field, the Clyde Field of the British National Oil Corp., was postponed. During 1980, a total of three field development permissions were given: Beryl B, Brae, and Hutton. After the end of the year, new Government tax measures were introduced in the form of an increase in the Petroleum Revenue Tax, a reduction in exemptions therefrom, and a new Supplementary Petroleum Duty. Thereafter, two companies announced postponement of development of oilfields, which they said was necessitated by the changes in taxation.

The seventh round of U.K. offshore licenses was announced during the year. For the first time, companies could designate desirable acreage (from an area east of the Shetlands), for which a payment of 5 million pounds sterling would be due upon award of license. By yearend, 42 blocks had been awarded. By early 1981, this number had risen to 79, representing the first modest increase in activity since the fourth round, as shown in the following tabulation:

Round	Year	Total number of blocks awarded
7th	1980-81	79
6th	1978-79	42
5th	1976-77	44
4th	1971-72	282
3d	1970	106
2d	1965	127
1st	1964	348

During 1980, 32 exploration wells were drilled. This was the smallest number since 1971 but was not greatly different from the totals of the previous 2 years. Meanwhile, the total number of exploration, appraisal, and development wells, at 176, stood at its highest total since 1977, as indicated below:

Year	Number of wells			
	Exploration	Appraisal	Development	Total
1980	32	22	122	176
1979	33	15	102	150
1978	37	25	96	158
1977	67	38	96	201
1976	58	28	54	140
1975	79	37	21	137
1974	67	33	20	120
1973	42	19	21	82
1972	33	8	36	77
1971	24	4	34	62

The oil-landing pipeline terminal at Sullom Voe in the Shetlands became operational during the year and had the capacity to accept some "live" crude as well as crude oil from which the gas has already been separated. The Brent and Ninian pipeline systems, from northern North Sea oilfields, both terminate at Sullom Voe and had a combined capacity of over 1 million barrels per day. Final completion of gas-processing facilities was estimated still to be more than a year away.

Total oil refining capacity in Great Britain stood at 2,630,000 barrels of crude per day during 1980, and no major expansions of basic capacity were underway. There are 19 refineries with basic crude capacities ranging from 5,500 to 355,000 barrels per day. Although various work on upgrading of refinery capability continued, particularly with respect to light ends, no new refineries were announced. No such announcement was anticipated in the near future, as refining activity continued to decline. By yearend, only 60% of basic capacity was being used.

[1]Supervisory physical scientist, Branch of Foreign Data.
[2]Exchange rate against the dollar was 0.450 in January and 0.419 in December.

The Mineral Industry of Venezuela

By Doris M. Hyde[1]

In real terms, the gross domestic product (GDP) grew by an officially estimated 1.6% in 1980 and amounted to $18.4 billion.[2] The deliberately low economic growth programmed by the Government for 1979 and 1980 was expected to rise to as much as 4.5% in real terms for 1981. The Sixth National Development Plan (1981-85) has projected an estimated average growth rate of 6.5% for the period. As shown below, revisions in the GDP for previous years indicate mostly lower percent growth rate figures since 1975 than were previously cited.

	1975	1976	1977	1978	1979
Current	5.9	8.3	7.0	3.3	0.8
Previous	5.7	7.9	7.7	4.9	4.1

In 1980, the mineral export sector, primarily the petroleum industry, accounted for 9.4% of the GDP. External sales of petroleum also contributed an estimated 72% of total Government income earnings compared with 67% in 1979.

The percentage contribution to the GDP made by the petroleum and mineral sectors are shown below:

	Contribution to GDP		Change from previous year	
	1979	1980	1979	1980
Petroleum	9.3	8.5	+6.1	-7.0
Mineral	.8	.9	+7.9	+6.9

The revised balance of trade surplus for 1979 was almost $3.4 billion instead of the $3.9 billion estimated earlier. For 1980, again primarily owing to gains in the petroleum market, the balance of trade surplus increased and was estimated at about $6.5 billion. In 1980, after 3 deficit years, a surplus of $2.6 billion was estimated on the current account of the balance of payments. Inflation grew to an unprecedented 23.1%, but leveled off to average an estimated 18% for the year.

Crude oil production generally declined in 1980 owing to well maintenance shutdowns and refinery modification projects, resulting in an output 3% less than targeted and almost 9% less than output produced in 1979. Internal demand for refined products continued to grow and increased by 9.4%. If domestic demand continues to rise at recent levels, internal consumption of crude oil by the end of this century could surpass 1.6 million barrels per day, up 360% over the 362,000 barrels per day consumed in 1980. There appeared to be a growing consensus within Government circles that domestic product prices, which now average about $8.00 per barrel of crude oil, must be increased to induce public conservation practices.

In 1980, iron ore production increased substantially, and internal sales accounted for 18% of total production. This represented a 314% gain over production sold domestically in 1979. Iron ore sales represented 82% of the estimated $259 million value of 1980 nonpetroleum mineral production. Coal continued a downward production trend and was almost 21% under production of 1979.

The taxable value of mined coal represented 0.3% of the total value of mineral production. Although production is projected to increase to 78,000 tons in 1981, until the coal deposits of Zulia State are developed, the near-future prospect for coal

is to remain of minor importance.

Gold, which in 1980 represented about 4% of total mineral production value, is expected to show a substantial production increase in 1981. The Minerven project, which initiated production in 1980, represents the major factor for projected production increases.

Diamond production has been subject to variations in grade and volume owing to the nature of occurrences. In 1980, diamonds represented about 14% of the value of total mineral production, down from 19% in 1979.

The prospect of bauxite mining by 1983 dimmed as the Fondo de Inversiones (FIV) continued to deliberate on various aspects of the final Los Pijiguaos feasibility study.

Government Policies and Programs.—The Sixth National Development Plan was designed to produce a balanced growth in all sectors, and it envisioned a larger role for the private sector. Petroleum, petrochemicals, steel, aluminum, and other areas in the metallurgical sector were given priority status. Stimulation is to be given to the private sector by reducing Governmental intervention and by opening the door to a freer play of market forces, both domestic and international.

In October 1980, the Government announced that about 60 State-owned companies (mostly in the metal, mechanical, tourism, and agroindustrial sectors) would be sold to private investors. All these companies are administered by the Corporación Venezolana de Fomento (CVF), which may retain a minority interest in some of them. It was reported that the private sector was considering the Government offerings with mixed enthusiasm.

Authorizations granted for new foreign investment practically doubled in 1980 and amounted to about $416 million, of which 80% was in the manufacturing sector and about 10% was in the construction sector. Actual foreign investment, however, increased by $104 million during 1980, a 5.2% growth, almost the lowest in 5 years. The Superintendencia de Inversiones Extranjeras (SIEX) has become more responsive to requests for authorizing foreign investment and somewhat more liberal in the interpretation of Andean Pact Decision 24. Increased foreign investment and SIEX's recent positive attitude toward it has not met with total approval from all political and Government sectors, and this reaction could impede foreign investment as investors weigh the consequences of possible future policy reversals.

The legal battle between the Government and the foreign oil company ex-concessionaires over back taxes and royalty payments continued. The Government has indicated that it will not negotiate, and the companies reportedly have indicated they will not acquiesce. To date, court decisions have been going against the companies, but appeal procedures have been initiated.

The unresolved question of the exact location of maritime boundaries between Venezuela and Colombia has been under negotiation for about 12 years. In October 1980, a draft agreement was published by the two countries, but internal opposition on both sides delayed formal signing. The main issues have been Venezuela's insistence that the Gulf of Venezuela is an "internal sea," over which it should have absolute sovereignty, and Colombia's insistence that the Los Monjes Islands are the territory of Colombia. In the proposed agreement, Colombia cedes its claim to Los Monjes and Venezuela recognizes limited Colombian rights in the Gulf. The draft covers, among other issues, the sharing and/or ownership of hydrocarbons. Although there has been no drilling in the gulf, Venezuela believes there may be about 10 billion barrels of oil in the area.

Venezuela's large territorial claim against Guyana was placed in a standby status in 1970 by the Port of Spain Protocol. This agreement expires at the end of 1981, and some discussions will probably ensue during 1981 on this matter.

On December 31, 1979, the Government published Decree 476, which consisted of new regulations pertaining to the treatment of technology contracts, including those for the provision of technical services, technical assistance, engineering and consulting services, and research and development. The regulations represent the determination of how (as provided in the Venezuelan income tax law) payments for technical assistance and services rendered abroad, but used to produce income in Venezuela, will be taxed. The decree marks the beginning of taxation on certain kinds of income received for work done in foreign countries. This could present double taxation problems to some U.S. companies and place them at a disadvantage when bidding against European and other competitors for technology contracts.

On August 3, 1980, Venezuela and Mexico

signed a joint agreement to guarantee a supply of 160,000 barrels of crude oil per day to Central American and Caribbean countries under special financing arrangements. Owing to a delay in signing all of the bilateral agreements with each recipient, only $49 million of the theoretical $306 million that Venezuela committed for the first year was actually dispersed during 1980. Jamaica and the Dominican Republic were the 1980 beneficiaries.

The basic principle of the financing facility (administered in Venezuela by the FIV) is to provide financing for 30% of the value of each participant's domestic consumption of crude oil. Venezuela's contribution should be one-half of the participant's total domestic consumption, the remainder coming from Mexico. The maximum amount of imported crude oil covered is stipulated in each separate agreement. Deposits are made by Venezuela quarterly (for its share of the total) in the recipient's central bank; terms are 4% interest, with repayment due after 5 years. The recipient's central bank issues a certificate of deposit with these terms to the FIV. The loans may be converted to a 20-year repayment schedule at 2% interest if the money is applied to energy or other development projects approved by the FIV.

Participants actually pay full price for the oil to Petróleos de Venezuela, S.A. (PDVSA). The loan funds come through FIV from its budget allocations received from the central Government, the source of which comes from petroleum revenues.

The Venezuela-Mexico financing accord was not Venezuela's first such arrangement. The first facility was uniquely Venezuela's and applied to the years 1975-80. It differed from the new facility in the criteria for determining how much financing should be made available and the terms of financing.

PRODUCTION

Petroleum continued to be the mainstay of Venezuela's mineral production. Output fell to 2.174 million barrels per day, somewhat below the targeted level of 2.22 million barrels per day, because of major maintenance projects on some of the wells in the Lake Maracaibo region and to work being undertaken at two refineries which necessitated production cutbacks. The 1981 production target was set at 2.158 million barrels per day.

For the second year, aluminum continued to be the second most valuable mineral industry, with output increasing substantially from both producers. The value of 1980 production was estimated at over $554 million. Production for 1981 was projected to approach maximum utilization of plant capacities.

The significant increase in steel production by C.V.G. Siderúrgica del Orinoco C.A. (SIDOR) did not alleviate the financial problems which have plagued the company.

Increased production and higher prices provided a boost to the iron ore industry as the value of production rose to $213 million, a 19% increase over that of 1979. Net profit to C.V.G. Ferrominera Orinoco C.A., however, dropped to insignificance as the company absorbed high production costs and its share of losses incurred by Compañía de Minerales Ordaz, C.A., the high-iron briquette plant jointly owned with United States Steel Corp. and Corporación Venezolana de Guyana (C.V.G.). For 1981, production has been targeted at about 19 million tons.

Coal production continued to decline, and the rehabilitation of the Naricual Mines was abandoned. Coal production will probably continue to be of minor importance until the Carbones del Zulia C.A. (Carbozulia) Mines are brought into production. Laboratory testing and engineering studies were under way on the Zulia coal. For 1981, national coal production has been targeted at 78,000 tons.

Other mineral production indicated a mixed performance during 1980. Gold showed almost a 100% increase in value for a 10% production increase over that of 1979. A 10% decrease in the output of industrial and bort diamonds and lower prices were responsible for the 21% decline in the total value of diamonds produced during 1980.

Table 1.—Venezuela: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
METALS					
Aluminum, unalloyed ingot	46,500	43,400	74,384	227,444	327,900
Gold, mine output, metal content—troy ounces	16,506	17,403	13,384	14,989	16,519
Iron and steel:					
Iron ore and concentrate—thousand tons	18,685	13,683	13,515	15,260	16,319
Metal:					
Pig iron—do	422	497	693	1,331	2,367
Ferroalloys:					
Ferromanganese—do	--	--	--	1	e2
Silicomanganese—do	--	--	--	1	e2
Ferrosilicon—do	2	11	e28	e39	e22
Total—do	r2	r e11	r e28	r e41	26
Steel ingots and castings—do	937	855	860	1,480	1,871
Semimanufactures, hot-rolled—do	1,174	1,162	1,081	1,224	1,398
Lead, secondary, smelter[e]	7,000	8,000	9,000	10,000	10,000
NONMETALS					
Cement, hydraulic—thousand tons	3,538	3,136	3,426	3,979	4,843
Clays:					
Kaolin	7,821	10,000	23,057	21,528	e22,000
Other—thousand tons	2,273	2,450	3,342	2,088	e2,000
Diamond:					
Gem—carats	195,700	203,600	269,400	247,239	237,800
Industrial—do	653,900	483,500	486,500	555,633	482,900
Total—do	849,600	687,100	755,900	802,872	720,700
Feldspar	65,608	26,020	70,262	88,902	36,065
Gypsum	110,841	155,892	366,855	420,613	3174,609
Salt, all types	e300,000	241,000	158,000	e155,000	243,145
Stone, sand and gravel:					
Stone:					
Broken stone and dust, not further described—thousand tons	NA	NA	1,694	1,459	e1,500
Dolomite	NA	NA	84,662	NA	NA
Granite	722	235	--	367	208
Limestone—thousand tons	21,515	18,995	32,736	19,872	19,074
Marble—cubic meters	NA	NA	139	191	e200
Serpentine	1,126	NA	NA	NA	NA
Sand and gravel—thousand tons	14,499	23,238	21,667	19,231	312,248
Sulfur, byproduct of petroleum and natural gas	90,000	95,000	95,000	85,201	e85,000
MINERAL FUELS AND RELATED MATERIALS					
Carbon black[e]—thousand tons	52	78	31	r e16	23
Coal, bituminous	86,600	120,800	90,000	55,400	44,000
Gas, natural:					
Gross—million cubic feet	1,311,392	1,324,702	1,230,428	1,304,624	1,251,864
Marketable—do	479,807	523,667	520,171	575,556	589,046
Natural gas liquids:[4]					
Condensate—thousand 42-gallon barrels	r727	r80	98	75	101
Natural gasoline—do	7,271	7,158	5,320	6,120	5,472
Liquefied petroleum gas—do	20,524	20,593	16,995	18,995	16,448
Total—do	r28,522	r27,831	22,413	25,190	22,021
Petroleum:					
Crude[5]—do	839,740	816,820	790,420	860,072	793,397
Refinery products:					
Gasoline:					
Aviation—do	672	710	200	271	276
Motor—do	43,344	47,260	51,810	54,102	57,557
Jet fuel—do	9,113	10,706	11,187	10,970	11,699
Kerosine—do	5,288	6,560	3,965	3,699	4,352
Distillate fuel oil—do	45,278	50,054	51,555	56,484	63,688
Residual fuel oil—do	216,028	200,645	206,335	202,306	168,906
Lubricants—do	2,464	2,389	2,873	3,163	3,277
Other:					
Liquefied petroleum gas—do	2,643	3,204	2,424	2,241	2,541
Asphalt and bitumen—do	3,734	4,285	5,544	7,798	6,871
Naphtha—do	22,781	20,141	17,320	16,906	12,752
Refinery gas[6]—do	6,807	6,766	6,534	6,692	6,497

See footnotes at end of table.

Table 1.—Venezuela: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979	1980[p]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other —Continued					
Unspecified					
thousand 42-gallon barrels	2,734	3,028	2,146	3,938	3,005
Total do	360,886	355,748	361,893	368,570	341,421

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 14, 1981.

[2]In addition to the commodities listed, lime is produced, but available information is inadequate to make reliable estimates of output levels.

[3]Officially reported figure, but may be incomplete.

[4]From nonassociated natural gas only.

[5]Includes associated natural gas lease condensate and natural gasoline. Lease condensate is included as follows, in thousand 42-gallon barrels: 1976—1,088; 1977—1,174; 1978—1,048; 1979—1,803; and 1980—1,900. Natural gasoline is included as follows, in thousand 42-gallon barrels: 1976—283; 1977—none reported; 1978—329; 1979—255; and 1980—250.

[6]Liquid equivalent.

TRADE

In 1980, crude oil and refined products valued at an estimated $17 billion accounted for about 94% of the total value of exports in contrast to the almost 96% share of value registered in 1979. Exports from the petroleum sector decreased from about 2.12 million barrels per day in 1979 to 1.81 million barrels per day in 1980. Total crude oil exports in 1980 amounted to 458.5 million barrels, and refined products amounted to 201.9 million barrels, an 11% and 22% decrease from that of 1979, respectively. This decline was attributed to a decreased world demand owing to generally depressed economies in the industrialized countries and to the energy policies of these countries which have intensified conservation. The average $17.36 per barrel value for 1979 petroleum exports increased substantially to $30.86 for 1980.

Lagoven, S.A., contributed about 45% of the total petroleum exports; Maraven, S.A., 35%; Corpoven, S.A., 16%; and Meneven, S.A., 4%.

In 1980, Venezuela provided directly about 3% of the total U.S. imports of crude oil and 6.5% of the combined direct imports of crude oil and refined products. The volume of crude oil and petroleum products exported to the United States decreased almost 40%, from 260.5 million barrels in 1979 to 156.6 million barrels in 1980. In 1981, Venezuela expects to export a total of 1.89 million barrels per day of crude oil, with about one-half directly and indirectly going to the United States.

Oil export policy changes in 1980 included limiting export contracts to 1 or 2 years, with provisions for price adjustments. Certificates of destination will be required to prevent Venezuelan oil from being manipulated or used in the spot market. Heavy crude oil will become the major export, while lighter grades will be used for negotiating purposes.

In 1980, iron ore exports decreased 9% from that of 1979. Of the 11.8 million tons exported, the United States received 31%, the Federal Republic of Germany 15%, Belgium 9%, Spain 8%, and lesser amounts to England, France, Holland, and other countries. The value of iron ore exports increased slightly to $142 million, or about 3% over the 1979 value, as the per ton value rose almost 6%, to $13.08. The value of internal sales leaped 371% over that of 1979 and amounted to $37.5 million in 1980. SIDOR accounted for 88% of domestic sales.

Total steel and sponge iron exports for 1979 were valued at $51 million, but in 1980 increased 46% to $72 million. Aluminum exports, which in 1979 reached $144 million and surpassed iron ore in value, by August 1980 were valued at almost $212 million and firmly established this product's second-place position among mineral and mineral-related exports for the foreseeable future.

Mineral imports in 1979 were valued at $269 million and accounted for about 2% of total imports.

COMMODITY REVIEW

METALS

Aluminum.—The 1-million-ton-per-year alumina plant under construction by Interamericana de Alumina, C.A. (Interalumina), was about one-quarter complete at the end of 1980. The plant, now estimated to cost over $1.1 billion due to cost overruns, is scheduled for completion in November 1982. This plant is expected to employ about 1,200 workers. It was reported that 45 to 60 Venezuelan engineers will be trained at a similar facility in Gove, Australia.

Venezuela has remained enthusiastic about the future of its aluminum industry in spite of some past financial disappointments. A draft of the new national plan for 1981-85 projected that by 1985 aluminum production would be 610,000 tons per year and that by 1990 it should reach 1 million tons per year. Current total capacity is 400,000 tons per year—120,000 tons from Aluminio del Caroni, S.A. (Alcasa), and 280,000 tons from Industria Venezolana de Aluminio (Venalum). There were reports that a merger between the two companies may be under consideration.

After 2 successive years of net losses, Alcasa ended its 1980 fiscal year registering almost a $2.5 million profit, as opposed to losses of $7.9 million in 1978 and $16.5 million in 1979. This has been described as a deceptive profit because Alcasa also received a Government export subsidy which amounted to $22 million for 1980. Alcasa's production and sales were both up in 1980, but the company maintained a high debt and/or equity ratio. At the end of 1980, Alcasa received a $58 million capital investment contribution from the FIV, which increased its interest in the company to 57.5% and reduced the Reynolds International, Inc., holding from 50% to 27.9%. Corp. Venezolana de Guayana has a 14.6% interest in Alcasa.

In August 1980, Alcasa completed its Phase IV plant expansion to 120,000 tons per year. Capacity to produce rolled aluminum also increased from 13,000 tons to 30,000 tons per year in 1980. Expansion to 320,000 tons of aluminum per year at Alcasa is expected to provide most of the projected 1985 increased national aluminum capacity. Financing for the estimated $300 million cost of this expansion has not been obtained.

The Venalum aluminum smelter operated at about 79% of its 280,000-ton-per-year capacity in 1980, producing 222,068 tons of aluminum. Expansion plans called for a fifth 70,000-ton-per-year potline to be installed by 1983 at a projected cost of $150 million. Venalum's startup losses, which amounted to about $22 million for 1979, were reversed in 1980, and the company showed a profit of about $50 million (including the Government export incentive subsidy of $23 million). Venalum was the second leading earner of foreign exchange after PDVSA, with 1980 export volumes amounting to 151,200 tons, valued at almost $248 million. Internal sales amounted to 55,200 tons, valued at $87 million. Japan received 130,600 tons, the major portion of Venalum's exports.

Venalum has encountered production problems owing to Venezuela's electricity shortage caused by delays in completing the Guri hydroelectric scheme. This shortage may cause Venalum to miss its targeted 1981 production figure of 268,000 tons. There is also the prospect of an increased power rate from the 2.56 cents per kilowatt-hour paid in 1980.

Another highly publicized Venalum problem has stemmed from efforts to renegotiate contracts with two of its alumina suppliers, Philipp Bros. and Metallgesellschaft AG. Venalum wanted to reduce the contract alumina price to 13% of Aluminum Co. of Canada Ltd.'s international reference price for aluminum ingot. This would represent a 2% reduction in the contract price during 1980, 2.5% in 1981, and 3% in 1982. Alumina shipments to Venalum were halted during the negotiations. Before the end of 1980, Venalum had successfully negotiated with Philipp Bros. and alumina shipments were resumed. The dispute with Metallgesellschaft may be taken to international arbitration.

Venalum management reportedly would also like to make some changes in its export contract with its Japanese consortium shareholder. The present 10-year contract provides for the delivery of 160,000 tons of aluminum per year at the Alcan international reference price minus a discount of 6%.

Bauxite.—The proposal to develop the Los Pijiguaos bauxite deposits has fallen about 1 year behind schedule owing to

funding delays and efforts to further maximize the efficiency of the operation. The FIV holds a 50% interest in the operating company, C.V.G. Bauxita Venezolana C.A. (Bauxiven), and Corp. Venezolana de Guayana (CVG) is the other partner in the joint venture. Final FIV approval and financing for the estimated $620 million project remained pending as alternative transportation and infrastructural plans were studied. The feasibility study by Aluminio Suizo, S.A. (Alusuisse), has also been closely scrutinized. If FIV gives final approval by mid-1981, the first ore shipment could take place in 1984.

It was reported that exploration surveys have indicated the presence of as much as 3 billion tons of bauxite reserves in eastern Venezuela, particularly in the Amazonas Territory.

Ferroalloys.—Fesilven (formerly Venbozel) mines a large silica-rich Cretaceous quartzite in eastern Venezuela. Ore is trucked to Puerto Ordaz where the 60,000-ton-per-year plant produces silicon metal and ferrosilicon. Venbozel was jointly owned by FIV (50%), CVG (25%), and the French company, Nobel Bozel (25%), until differences in 1980 caused Bozel to withdraw. The company, renamed Fesilven, was reorganized, received additional subscribed capital, and ownership was then distributed among FIV, CVG, SIDOR, and Credit Lyonnaise through the conversion of Venbozel's debt into preferred shares. In 1980, FIV increased its interest to 34.6% by subscribing additional capital.

Production was expected to reach capacity in 1981, and after some plant modifications, 1982 production is expected to reach 64,000 tons. About 90% of production has usually been exported, Japan being the prime receiver followed by the United States. The remaining production is consumed by SIDOR in steel deoxydizing and in silicon steel production.

Ferromanganese is produced by Hornos Electricos de Venezuela, S.A. (Hevensa), a mixed company composed of 50% Mexican, 25% Venezuelan, and 25% Japanese capital. Originally established as a ferrosilicon producer, operations changed to ferromanganese production using imported raw material. Production capacity was reported to be about 18,000 tons per year, with reports of actual production varying between 6,000 and 12,000 tons per year.

Venezuela has been reported as having about 2 million tons of ore reserves grading 20% to 40% manganese located in the Upata region of northern Bolívar State. Other deposits of manganese have been reported as associated with the metamorphic iron belt also in northern Bolívar State.

Gold.—The increased price of gold during 1979 and 1980 has stimulated some additional production. While 1980 production increased about 10% over that of 1979, the value increased by almost 100% to $9.56 million in 1980. The Government expects a sharp increase in 1981 gold production of almost 80,000 ounces.

In 1980, State-owned Cía. Minera de Venezuela (Minerven) accounted for 26% of total gold production. The Sindicato de Patrones Mineros contributed 50% of production, independent miners 18%, and other concessionaires 6%. Minerven completed mining preparations in the El Callao region of Bolívar State. Proven reserves were established at 250,000 tons grading almost 0.39 ounce gold per ton. The processing plant began operations at a capacity of 240 tons per day.

Iron Ore.—About 45% of iron ore production came from the Cerro Bolívar Mines, 29% from Cerro El Pao, and 25% from Cerro Altamira. Production at Cerro San Isidro dropped to about 105,300 tons, and no production was reported after March 1980. Net profit to CVG Ferrominera del Orinoco, C.A., was about $40,000, drastically lower than last year's revised profit of $6.8 million. The low profit was attributed to losses incurred at the Cía. Minerales Ordaz briquette plant. Ore production for 1981 was expected to reach 18.8 million tons as a result of an investment of $7 million to expand and improve the mining installations and over $10 million for equipment maintenance and to upgrade facilities. The 20-kilometer railroad linking SIDOR's pelletizing plant and Ferrominera was opened during the first half of 1980.

In 1980, internal sales of iron ore amounted to 2.9 million tons, an increase of 314% over that of 1979. SIDOR accounted for 88%, and Fior de Venezuela accounted for 12% of internal sales.

At the end of 1980, proven high-iron content ore reserves were estimated at 1.73 billion tons, about 10% less than at the beginning of the year. The distribution of reserves is as follows in million tons: San Isidro 390, María Luisa 258, Los Barrancos 232, Cerro Bolívar 218, La Estrella y Redondo 165, Arimagua 136, Altamira 128, Las

Pailas 80, San Joaquin 65, El Pao 44, and Toribio 18. In addition, ferruginous quartzite reserves (29% to 50% Fe) in the Cinturón Ferrifero de Imataca are estimated at 10 billion tons.

Iron and Steel.—After pilot testing in 1979 and early 1980, the high-iron briquette direct-reduction plant of Cia. de Minerals Ordaz, C.A. (Minorca) resumed operations in mid-1980 and was expected to produce 400,000 tons that year and 600,000 tons in 1981. Minorca is 51% owned by Ferrominera, with United States Steel Corp. holding the minority interest. Actual production at Minorca was 226,000 tons, of which about 29% was exported, and the rest sold locally.

SIDOR increased steel production to 1.78 million tons in 1980, an increase of 39% over that of 1979. Interior sales were estimated at 1.64 million tons, valued at $762 million. Export sales were estimated at about 300,000 tons, valued at $72 million. These figures represent increases over that of 1979 of 43% and 46%, respectively. Export sales of semimanufactured steel totaled over 245,000 tons, while sponge iron exports were about 53,500 tons.

NONMETALS

In 1980, it was reported that more than $2 billion has been planned for investment in various industrial mineral projects. The private cement, ceramic, glass, refractory, and paint industries are actively developing new mines to produce raw materials for their plants. Many of these industrial minerals do not require special mining permits, mineral ownership being vested in the landowner.

Nonmetallic minerals occurring in Venezuela include: Asbestos, barite, bentonite, chalk, diamonds, diatomite, dolomite, feldspar, gneiss and granite, gypsum, ilmenite, kaolin, kyanite, limestone, magnesium, marble, mica, natural asphalt, ocher, peat, phosphate, quartz and quartzite, rare earth, salt, sand, silica, sulfur, talc, and white clays. Of these known mineral occurrences, 17 are reported as presently mined, 4 are scheduled for mining in the near future, and 8 are under exploration and evaluation studies.

The Government does not report the value of industrial mineral production, and their worth is not taken into account when estimating the mineral sector's contribution to the economy. The reporting of production and classification of material is not always consistent and may not be inclusive.

Cement.—Producers were unable to provide for domestic demand and as import contracts expired, renewal was hampered because the price of Venezuelan cement is fixed at an amount considerably lower than the world market price. This situation could result in a cement shortage during 1981 of up to 18 million bags.

The new computerized cement plant of Cementos Caribe S.A. came onstream in Falcón State in late 1979 at a rating of 3,000 tons per day of finished cement. Consolidada de Cementos C.A. initiated construction of a 2,400-ton-per-day dry-process cement plant in San Sebastian. The $46 million plant is expected to become operatonal at the end of 1982.

Diamonds.—The controlled production of diamonds declined over 10% in 1980, because of lower production of bort-grade diamonds. Concessionaires were reported as producing less than 1% of the total national production; independent miners provided the remainder. Production in 1980 was valued for tax purposes at $35.2 million, a decrease of almost 21% from the 1979 value of $44.3 million.

Magnesite.—The mining law presently classifies magnesite as a common mineral not subject to special regulation. Certain legal and ownership problems have effectively blocked mining, and there has been no production. Reserves on Margarita Island are estimated at 14 million tons.

MINERAL FUELS

Coal.—The C. A. Minas de Carbón de Lobatera Mines in Tachira State supplied 94% of total 1980 coal production. C. A. Minas de Carbón de Naricual produced 5% of total production. The Consejo Nacional de la Industria del Carbón, in consensus with the Ministry of Energy and Mines and the Oficina Central de Coordinación y Planificación (CORDIPLAN) concluded that the rehabilitation of the Naricual Mines was not progressing satisfactorily, and the company was liquidated with the coal deposits passing to Corp. de Desarrollo de la Region Nor-Oriental (CORPORIENTE) ownership.

Carbones del Zulia, C.A. (CARBOZULIA), the State company established to exploit the Guasare coal deposits in the State of Zulia, continued its mine drilling program. Coal exploration activities were under way in the carboniferous zone of Tachira State. Topographic mapping was concluded in the area, and drilling was expected to begin in

early 1981.

Petroleum and Natural Gas.—In 1980, PDVSA was the largest Third World firm and ranked in 15th place among the 100 largest companies outside the United States. In 1980, PDVSA invested almost $2 billion in exploration, production, refining, and complementary operations involved in marketing and administration. This was an amount lower than originally planned, but substantially more than the $1.5 billion spent in 1979. Over 15% of the 1980 investment was allocated to exploration activities, almost 46% to production, and 26% to refining operations. An investment increase to $2.9 billion was planned for the 1981 spending program. About 44% of this amount will be allocated for exploration activities.

The petroleum industry's net earnings in 1980 increased to $3.3 billion, a 13% increase over 1979 net earnings. The profit gain reflected increases in prices. During 1980, the average realized per barrel price of exported crude oil rose from $17.47 to $25.85, while the average price for refined products increased from $19.50 to $27.30 per barrel.

The 1980 yearend estimate of crude oil reserves increased to 19.6 billion barrels, a gain of 6% over that of 1979. Natural gas reserves at the end of 1980 increased slightly to an estimated 45.5 trillion cubic feet. Almost 95% of the reserves are classified as associated gas.

More natural gas was utilized during 1980 despite a production decrease from that of 1979. Of total production, 47% was injected into formations, 16% was used by the petroleum industry, 26% was marketed, 5% was transformed into products, and 6% was flared.

Light-gravity crude oil—more than 22.9° A.P.I.—production decreased 12% from production of 1979, and in 1980 accounted for over 54% of total production. Medium-gravity oil—from 22.9° A.P.I. to 14° A.P.I.—constituted 26% of production, and heavy oil—less than 14° A.P.I.—contributed almost 20% to total production. Medium and heavy oil production decreased 3% and 0.7%, respectively, from that of 1979. Lagoven, S.A., was the largest crude oil producer (41%), followed by Maraven, S.A. (28%), Corpoven, S.A. (15%), and S.A. Meneven (16%).

All four of these PDVSA subsidiary companies produced petroleum from the Maracaibo region, which accounted for 78% of total national production. Corpoven, Lagoven, and Meneven together produced 8% of total national production from the Maturin region; Corpoven and Meneven produced 12% from the Barcelona region; and Corpoven alone accounted for the 2% contribution to total national production from the Barinas region.

In 1980, there were 43 producing fields in the Maracaibo Basin, and they contributed 78% to total national production. The Eastern (Oriental) Basin, with 116 producing fields, accounted for 20% of production; the Apure Basin, with 8 fields, accounted for almost 2%; and the 3 active fields in the Falcón Basin contributed considerably less than 1%. At the end of 1980, there were 13,491 active wells, of which 13,453 produced crude oil and 38 produced natural gas. There were also 843 injection wells.

The operating companies continued exploration work, searching primarily for light- and medium-grade crude oil through extensions of exiting fields and in new areas where geophysical testing was favorable. Successful offshore drilling continued in the same general areas which showed promise in the 1979 drilling programs. A gas exploration program was begun in north-central Venezuela in the States of Guárico and Monagas.

Exploration also continued in the Orinoco heavy oil belt to better determine the extent and potential reserves of this 19,000-square-mile area along the northern side of the Orinoco River. Development of the "Faja," as this region is commonly called, has been divided among the four operating companies. Lagoven has outlined an ambitious drilling and recovery program projected to cost $8 billion for its Cerro Negro project, or Desarrollo del Sur de Mongas y Anzoátegui (DSMA). At Cerro Negro, Lagoven is experimenting with different methods of steam injection. Lagoven's plans include drilling 1,000 wells, constructing 15 flow stations, 60 steam boilers, and a plant to remove heavy carbons from the crude oil. A $3 billion infrastructure development includes a town and 1,000 kilometers of water and oil pipelines. Lagoven plans to include as many local companies as possible in the project, but its scope necessarily requires some foreign consultants. Bids for a general executive coordinator have been received, and a selection is expected early in 1981.

The use of foreign contractors and the push to develop the Orinoco reserves at this

time has not received unanimous private and public approval. Pro-developmentalists deny the presence of foreign influence in Venezuelan petroleum affairs and emphasize the necessity for preparing now for projected national energy demands in the next century and for continued production for the export market.

Meneven's development of the Faja crude oil reserves is expected to be assisted by the company's existing production facilities nearby in Anzoátegui State. Maraven is exploring and evaluating the "Zuata" L area in the States of Guarico and Anzoátegui. The company planned to have 73 wells completed by the end of 1981. Corpoven has been exploring the Machete area in Guarico State and planned to complete 123 wells by the end of 1981.

Venezuela is proceeding with its $2 billion refinery upgrading projects designed to produce more gasoline to meet a growing internal demand and to accommodate a greater percentage of heavy crude oil in the refinery input. In 1980, refinery capacity did not change from the 1979 total of 1,445,000 barrels per calendar day.

Projected costs have increased on Lagoven's Amuay refinery modification, now estimated at $770 million. Construction is on schedule for the mid-1982 startup which will add 50,000 barrels per day to Amuay's gasoline production capacity, 22,000 barrels per day to distillate output, and will lower high-sulfur fuel oil production by 77,000 barrels per day. The refinery is expected to be able to handle a throughput of 44% extra-heavy crude oil.

Corpoven's $360 million El Palito refinery upgrading project fell behind schedule, but was expected to be completed in September 1981. Gasoline production capacity at El Palito should reach 77,000 barrels per day, and residual output will drop to 29,000 barrels per day with a viscosity over seven times higher than that now produced. The residual will be piped to a nearby electrical generating plant.

By 1985, Meneven's Puerto La Cruz refinery is scheduled to replace its catalytic cracker with a 52,500-barrel-per-day Pullman Kellogg fluid unit and two new vacuum units. Heavy oil refining capacity will be increased by 25,000 barrels per day. The investment cost was estimated at $730 million.

Maraven's Cardón refinery at Punto Fijo on the Paraguaná Peninsula, 16 miles south of the Amuay refinery, has also been slated for modification. The heavy crude input, now about 30,000 barrels per day, is to be converted into diesel and other products rather than the present production of reconstituted crude oil.

By 1984, Venezuela's refineries should have decreased the input of light- and medium-gravity crude oil while increasing heavy and extra-heavy grades. Output of gasoline, No. 2 fuel oil, and low-sulfur fuel oil should increase, while that of kerosine, jet fuel, and high-sulfur fuel oil are expected to decrease. Projections of increased internal demand for gasoline are expected to require additional refinery modifications every 2 to 3 years after 1986.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Venezuelan bolivars (Bs) to U.S. dollars at the rate of Bs4.30=US$1.00.

The Mineral Industry of Yugoslavia

By Roman V. Sondermayer[1]

Although Yugoslavia continued to be one of the prominent producers of nonferrous metals in Europe during 1980, lead and zinc output was not adequate to supply all domestic needs. It is uncertain whether significant imports of lead and zinc concentrates, which started in 1970-75, will become permanent, or whether they were a temporary measure. Efforts to increase mine output of ores during 1980 were not satisfactory.

By world standards, the mineral industry of Yugoslavia was modest. The more prominent minerals with production in 1980 expressed as percentage of world output were as follows: Antimony 2.3%, bauxite 3.5%, lead mine 3.4%, alumina 2.6%, lead smelter 2.6%, magnesite 2.4%, bismuth 2.2%, zinc mine 1.7%, zinc smelter 1.4%, copper smelter 2.3%, copper refined 1.5%, copper mine 1.8%, and aluminum 1.2%. Production of other minerals was of domestic significance only.

The mineral industry contributed 7.1% of the gross social product (GSP) and 6.1% of the total employment. The share of the mineral industry including processing in the GSP (tantamount to the Western equivalent of gross national product) for 1979 (latest year available) and employment is shown in the following tabulation:[2]

Branch	Million dinars	Employment, thousand persons
Coal:		
Production	11,025	53.8
Processing	1,021	3.2
Crude oil:		
Production	3,896	4.4
Processing	8,434	9.8
Iron and steel:		
Iron ore, production	990	5.1
Steel, production	13,774	52.7
Nonferrous metals:		
Production of ores	5,595	26.8
Metal, production	3,688	15.2
Metal, processing	4,096	14.1
Nonmetallics:		
Production	2,167	12.4
Processing	8,004	46.9
Sand and gravel	4,635	22.9
Construction material	14,935	71.3
Total	82,260	338.6

Principal events related to the mineral industry during 1980 were as follows: Development of the copper mine at Veliki Krivelj in Srbija (Serbia); construction of an aluminum plant at Bacevici, Bosna i Hercegovina (BiH); startup of a new furnace for production of silicon at Ruse, Slovenija (Slovenia); start of production from first magnesium metal-producing plant in Yugoslavia, located in Serbia; continuing development of a nickel mine and plant in Rzanovo, Makedonija (Macedonia); construction of ammo-

nia plants in Pancevo, Serbia, and Kutina, Hrvatska (Croatia); and startup of a gasfield at Molve in Croatia.

PRODUCTION

The mineral industry was State-owned; however, investment of foreign capital in Yugoslavia's mineral industry was allowed. The size of enterprises ranges from large, integrated operations, mostly in production of metals, to small mines, mostly in production of nonmetals. Table 1 shows latest trends in the mineral production of Yugoslavia.

Table 1.—Yugoslavia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS					
Aluminum:					
Bauxite thousand tons	2,033	2,044	2,565	3,012	[3]3,138
Alumina	455,276	499,341	496,479	836,428	1,000,000
Metal ingot:					
Primary	182,650	176,468	175,950	167,681	164,760
Secondary	15,029	20,989	19,758	21,841	20,000
Total	197,679	197,457	195,708	189,522	[3]184,760
Antimony:					
Mine output, metal content	[r]2,021	2,248	2,676	2,037	2,100
Metal (regulus)	2,332	1,024	1,791	2,401	[3]2,237
Bismuth, smelter output	78	74	13	23	[3]83
Cadmium, smelter output	[e]180	189	187	289	290
Chromium:					
Chromite ore (domestic production)	2,021	1,546	1,907	168	170
Chromite concentrate (produced largely from imported ores)	34,911	51,331	52,771	90,500	91,000
Copper:					
Mine and concentrator output:					
Ore, gross weight thousand tons	17,377	17,533	17,098	16,446	[3]19,559
Concentrate:					
Gross weight	471,000	457,000	508,000	478,000	560,000
Cu content	120,130	116,218	123,319	111,421	134,000
Metal:					
Blister:					
Primary	[e]99,000	97,397	107,507	108,732	110,000
Secondary	[e]65,139	68,426	87,666	71,250	72,000
Total	[e]164,139	165,823	195,173	179,982	182,000
Refined:					
Primary	121,587	92,977	103,906	99,224	100,000
Secondary	14,883	50,539	46,922	38,280	31,288
Total	136,470	143,516	150,828	137,504	[3]131,288
Gold metal, refined troy ounces	157,088	164,226	142,556	138,987	138,000
Iron and steel:					
Iron ore:					
Gross weight thousand tons	4,269	4,451	4,564	4,617	[3]4,530
Fe content do	1,499	1,514	1,621	1,619	1,600
Iron concentrate do	1,646	1,726	1,713	1,636	1,650
Metal:					
Pig iron do	1,918	1,938	2,081	2,360	[3]2,425
Ferroalloys:					
Ferrochrome	42,770	36,150	51,213	65,622	63,000
Ferromanganese	22,221	54,639	37,470	45,591	44,000
Ferrosilicon	98,668	55,513	60,189	67,884	67,000
Silicon metal	[4]	27,476	30,670	31,598	31,000
Ferrosilicomanganese	25,848	8,737	27,857	28,786	28,000
Ferrosilicochrome	7,123	5,257	7,998	6,785	7,000
Other	3,716	1,719	3,132	3,521	3,000
Total	200,346	189,491	218,529	249,787	[3]243,000

See footnotes at end of table.

Table 1.—Yugoslavia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Crude steel:					
From oxygen converters thousand tons	269	724	1,048	1,071	[3]1,149
From Siemens-Martin furnaces do	1,651	1,587	1,494	1,476	[3]1,459
From electric furnaces do	831	873	909	990	[3]1,026
Total do	2,751	3,184	3,451	3,537	[3]3,634
Semimanufactures do	2,440	3,329	4,142	4,140	[3]4,244
Lead:					
Mine and concentrator output:					
Ore, gross weight (lead-zinc ore) do	3,806	4,162	4,078	4,115	4,300
Concentrate:					
Gross weight	157,331	169,504	163,501	168,971	168,000
Pb content	122,466	129,977	129,389	129,776	129,000
Metal:					
Smelter:					
Primary	98,500	111,700	100,300	92,000	91,000
Secondary[5]	41,833	33,341	40,069	41,603	42,000
Total	[r]140,333	145,041	140,369	133,603	133,000
Refined:					
Primary[6]	93,520	111,690	100,300	92,040	84,750
Secondary	17,700	18,200	16,400	19,000	17,000
Total	111,220	129,890	116,700	111,040	[3]101,750
Manganese ore:					
Gross weight	19,000	24,750	27,400	30,150	30,000
Mn content	6,550	8,702	9,771	10,552	10,000
Mercury 76-pound flasks	12,503	3,133	--	--	--
Platinum-group metals:					
Palladium troy ounces	NA	4,951	5,562	5,241	5,150
Platinum do	NA	739	418	675	640
Selenium metal, refined kilograms	45,080	50,360	52,840	46,257	46,000
Silver, refined, including secondary thousand troy ounces	4,631	4,679	5,125	5,214	[3]4,790
Zinc:[7]					
Concentrator output:					
Gross weight	171,830	183,938	173,817	167,907	150,000
Zn content	106,641	112,383	103,794	101,699	100,000
Smelter, including secondary	95,469	98,845	95,232	98,906	[3]84,537
NONMETALS					
Asbestos (fiber)	12,830	9,036	10,304	9,959	10,000
Barite	56,122	52,245	42,800	46,073	45,000
Cement, hydraulic thousand tons	7,620	8,006	8,698	8,081	[3]9,315
Clays:					
Fire clay:					
Crude	331,885	305,171	354,635	390,759	400,000
Calcined	78,532	81,949	110,863	105,680	106,000
Kaolin	NA	110,817	180,017	177,958	180,000
Feldspar, crude	25,386	56,146	48,013	56,160	56,000
Gypsum:					
Crude	422,260	482,552	502,904	567,746	570,000
Calcined	82,470	96,540	99,722	119,041	120,000
Lime:					
Quicklime thousand tons	1,167	1,261	1,297	1,526	1,600
Hydrated do	760	786	758	875	900
Total do	1,927	2,047	2,055	2,401	2,500
Magnesite:					
Crude	391,000	345,000	333,000	293,000	[3]262,000
Sintered	189,884	164,180	151,782	145,723	140,000
Caustic calcined	4,844	8,763	8,166	9,939	10,000
Mica, all grades	68	139	69	338	300
Nitrogen: N content of ammonia thousand tons	387	417	416	418	416
Pumice and related volcanic materials: Volcanic tuff	NA	355,061	247,811	170,594	170,000
Quartz, quartzite, glass sand:					
Quartz and quartzite thousand tons	NA	483	227	239	240
Glass sand do	NA	1,448	1,717	1,923	1,900
Total do	1,607	1,931	1,944	2,162	2,140

See footnotes at end of table.

Table 1.—Yugoslavia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
NONMETALS —Continued					
Salt:					
Marine	12,881	20,576	20,966	20,500	NA
From brines	185,000	188,000	192,000	192,000	NA
Rock	91,230	85,210	85,231	137,441	NA
Total	289,111	293,786	298,197	349,941	377,000
Sand and gravel (except glass sand) thousand cubic meters	14,505	16,163	20,692	26,845	[3]27,029
Sodium compounds: Sodium carbonate do	137,232	156,826	166,350	164,382	165,000
Stone (except quartz and quartzite):					
Dimension:					
Crude:					
Ornamental do	50	55	58	69	NA
Other do	1	6	10	5	NA
Partly worked facing thousand square meters	779	934	1,074	1,274	NA
Cobblestones, curbstones, other thousand cubic meters	32	15	17	10	NA
Dolomite thousand tons	NA	382	557	673	NA
Limestone do	NA	3,149	3,778	4,125	NA
Shale do	NA	6,743	7,603	8,053	NA
Crushed and broken, n.e.s. thousand cubic meters	4,034	[r]5,503	6,785	8,703	NA
Milled marble and other do	4,364	5,529	6,234	8,813	NA
Sulfur and pyrite:					
Pyrite, gross weight thousand tons	440	394	406	452	450
Sulfur:					
S content of pyrite do	185	166	171	190	189
Byproduct:					
Of metallurgy[e] do	200	200	200	200	200
Of petroleum[e] do	5	5	5	5	5
Total do	390	371	376	395	394
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	21,794	23,884	25,823	23,261	23,000
Coal:					
Bituminous thousand tons	[r]587	[r]510	471	434	[3]388
Brown do	9,110	8,960	8,854	9,351	[3]9,665
Lignite do	[r]27,148	[r]29,611	30,359	32,329	[3]36,949
Total do	36,845	[r]39,081	39,684	42,114	[3]47,002
Coke:					
Metallurgical do	1,686	1,662	1,778	2,161	NA
Breeze do	100	103	143	175	NA
Foundry do	NA	133	150	151	NA
Total do	NA	1,898	2,071	2,487	[3]2,628
Gas:					
Manufactured (excluding petroleum refinery gas):					
From coke plants million cubic feet	NA	9,401	14,117	18,890	NA
From lignite gasification plants do	3,269	3,467	4,025	3,749	NA
From other gas generators do	NA	915	721	401	NA
Natural, gross production do	61,094	66,902	68,334	65,579	64,272
Natural gas plant liquids:					
Natural gasoline and pentane thousand 42-gallon barrels	120	100	98	149	NA
Propane and butane do	607	567	590	531	NA
Total do	727	667	688	680	NA
Petroleum:					
Crude:					
As reported thousand tons	3,880	3,951	4,076	4,143	[3]4,229
Converted thousand 42-gallon barrels	28,739	29,265	30,190	30,687	31,324
Refinery products:[8]					
Gasoline do	16,346	18,964	20,230	22,177	[3]21,318
Jet fuel do	[r]2,518	[r]2,682	2,437	2,695	NA
Kerosine do	78	76	81	254	NA
Distillate fuel oil:					
Diesel do	22,149	25,737	25,894	29,214	[3]24,790
Other do	1,257	--	--	--	--
Residual fuel oil do	31,968	38,748	40,753	43,217	[3]44,289
Lubricants do	[r]1,307	[r]1,719	2,713	2,898	NA

See footnotes at end of table.

Table 1.—Yugoslavia: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1976	1977	1978	1979[p]	1980[e]
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum —Continued					
Refinery products:[8] —Continued					
Other:					
Liquefied petroleum gas thousand 42-gallon barrels	2,660	3,000	2,873	2,898	NA
White spirit do	248	272	276	250	NA
Paraffin do	75	82	104	125	NA
Asphalt and bitumen do	2,369	3,254	3,842	4,497	NA
Petroleum coke do	306	r336	362	300	NA
Total[8] do	r81,281	r94,870	99,565	108,525	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 16, 1981.

[2]In addition to the commodities listed, germanium, bentonite, common clay, and diatomite are also produced, and tellurium may be recovered as a copper refinery byproduct, but available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Apparently included with ferrosilicon.

[5]Calculated as the difference between reported total and reported primary figure.

[6]Calculated as the difference between reported total and reported secondary figure.

[7]For ore production, see under "Lead."

[8]Excludes refinery gas, which was as follows, in million cubic feet: 1976—12,639; 1977—15,351; 1978—14,086; 1979—15,050; and 1980—NA; also excludes other materials produced by and used in the refineries as fuel.

TRADE

During 1980, Yugoslavia remained a net importer of minerals. Tables 2 and 3 show details of mineral trade of Yugoslavia.

Table 2.—Yugoslavia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	676,163	524,928	--	U.S.S.R. 248,722; Czechoslovakia 142,189; Romania 92,260.
Alumina	79,028	395,378	--	U.S.S.R. 289,256; Poland 84,577; Czechoslovakia 19,707.
Oxide and hydroxide	23,090	68,374	--	West Germany 35,831; Poland 32,420.
Metal including alloys:				
Scrap	3,127	352	--	Italy 301; West Germany 46; Austria 5.
Unwrought	58,730	46,180	--	East Germany 27,620; Czechoslovakia 5,101.
Semimanufactures	55,055	50,302	9,125	Czechoslovakia 16,032; East Germany 5,655.
Antimony, regulus	1,485	975	45	U.S.S.R. 730; Bulgaria 200.
Cadmium metal including alloys, all forms	176	133	71	West Germany 38; United Kingdom 10.
Chromium:				
Chromite	5,854	10,475	--	All to Czechoslovakia.
Oxide and hydroxide	10	125	--	All to Italy.
Copper:				
Copper sulfate	11,699	21,843	--	Turkey 15,384; Greece 3,572; China, mainland 2,205.
Metal including alloys:				
Scrap	3,682	7,948	--	West Germany 3,013; Switzerland 2,464; Italy 2,159.
Unwrought	16,070	8,356	3,563	East Germany 1,431; Italy 1,308.
Semimanufactures	26,711	29,814	2,495	U.S.S.R. 8,298; Czechoslovakia 4,277; West Germany 3,751.
Iron and steel:				
Ore and concentrate	16,290	2	--	Mainly to Sweden.
Roasted pyrite	33,833	48,302	--	Hungary 43,107; Austria 5,195.

See footnotes at end of table.

Table 2.—Yugoslavia: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal:				
Scrap	79,288	45,611	--	Italy 39,176; West Germany 2,845; Switzerland 2,789.
Pig iron, ferroalloys, similar materials	179,381	212,109	68,080	Romania 36,888; Italy 36,254; West Germany 18,579.
Steel, primary forms	16,551	22,494	--	Hungary 13,416; Poland 7,914.
Semimanufactures:				
Bars, rods, angles, shapes, sections	87,130	133,128	--	U.S.S.R. 40,188; Romania 26,741; West Germany 11,535.
Universals, plates, sheets	28,565	36,691	--	West Germany 13,249; Turkey 7,809; Poland 5,497.
Hoop and strip	3,430	5,403	1	Poland 2,832; Bulgaria 1,246.
Rails and accessories	27,875	32,049	--	Romania 22,515; Poland 9,161.
Wire	520	1,970	--	Madagascar 942; U.S.S.R. 433.
Tubes, pipes, fittings	183,506	102,247	311	China, mainland 19,869; East Germany 16,815.
Castings and forgings, rough	r4,863	4,401	--	Poland 1,532; Austria 1,075; West Germany 698.
Lead:				
Ore and concentrate	39,893	13,496	--	Bulgaria 6,823; West Germany 5,441; U.S.S.R. 1,229.
Oxide kilograms	1,408	725	--	East Germany 616; Iraq 109.
Metal including alloys:				
Unwrought	47,923	36,990	--	U.S.S.R. 20,380; Czechoslovakia 9,902.
Semimanufactures	1,601	2,377	--	Italy 1,012; France 662.
Manganese ore and concentrate	--	922	--	All to Albania.
Nickel:				
Ore and concentrate kilograms	1,000	1,080	1,080	
Metal including alloys:				
Waste and scrap	289	210	--	Switzerland 58; West Germany 57; Italy 27.
Unwrought	--	137	--	Austria 72; West Germany 65.
Semimanufactures	19	27	--	Austria 21; Bulgaria 5.
Platinum metal including alloys, all forms troy ounces	66,745	64,205	6,302	Netherlands 32,343; West Germany 25,560.
Silicon	27,825	26,496	2,856	U.S.S.R. 11,894; Italy 2,930; West Germany 2,927.
Silver metal including alloys, all forms thousand troy ounces	2,182	3,009	1,532	West Germany 503; Czechoslovakia 370; Italy 180.
Tin metal including alloys, all forms	65	115	--	West Germany 101; Switzerland 13.
Titanium oxides	13,453	12,132	425	East Germany 11,592; Italy 100; France 15.
Zinc:				
Ore and concentrate	2,271	6,600	--	Bulgaria 5,266; Austria 1,334.
Oxide	r1,277	1,669	--	Romania 1,050; Hungary 490; West Germany 122.
Metal including alloys:				
Unwrought	45,241	31,578	--	Czechoslovakia 15,223; U.S.S.R. 12,484; Hungary 2,305.
Semimanufactures	9,253	9,070	--	Czechoslovakia 5,921; West Germany 1,322; U.S.S.R. 1,022.
Other:				
Ash and residue of nonferrous metals	28,991	23,762	--	Bulgaria 18,869; Italy 3,900.
Oxides, hydroxides, and peroxides of metals n.e.s	87	92	--	Mainly to Sweden.
NONMETALS				
Abrasives, natural, n.e.s.:				
Grinding and polishing wheels and stones	2,773	2,832	25	Romania 1,385; Poland 310; Bulgaria 239.
Artificial corundum	15,809	15,908	17	Romania 5,652; Italy 3,146; Czechoslovakia 2,134.
Asbestos	1,902	1,983	--	Albania 1,657; West Germany 200; Bulgaria 105.
Barite and witherite	16,495	13,965	--	Hungary 7,607; U.S.S.R. 6,358.
Cement	326,079	359,920	13,552	Egypt 184,890; Tunisia 74,780; Yemen 33,840.
Chalk	15	2	--	Mainly to West Germany.
Clays and clay products (including all refractory brick):				
Crude:				
Bentonite	136	297	--	Switzerland 200; Tunisia 50; Sudan 25.
Fire clay	9,975	18,918	--	Italy 17,795; Greece 1,066.
Kaolin	9,812	5,618	--	Greece 5,452; Italy 157.

See footnotes at end of table.

Table 2.—Yugoslavia: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products (including all refractory brick) —Continued				
Products:				
Refractory (including nonclay brick)	61,923	77,120	--	Romania 25,688; Albania 15,925; West Germany 10,559.
Nonrefractory	7,153	7,698	26	Austria 2,272; United Arab Emirates 1,511; U.S.S.R. 1,336.
Feldspar	7,904	9,695	--	Hungary 7,680; Czechoslovakia 1,151; Greece 864.
Fertilizer materials, manufactured:				
Nitrogenous	72,819	46,630	--	Turkey 28,317; Ecuador 10,056; West Germany 8,250.
Phosphatic	160,263	98,787	--	Hungary 78,378; Czechoslovakia 19,799.
Potassic kilograms	--	885	--	All to U.S.S.R.
Other including mixed	184,090	319,243	--	Hungary 104,708; Turkey 97,312; Nigeria 36,000.
Gypsum and plasters	288	357	--	Hungary 308; Poland 22; Kuwait 10.
Lime	27,534	59,319	--	Hungary 33,371; Kuwait 25,775.
Magnesite	31,348	28,325	--	Poland 17,089; Italy 3,783; West Germany 3,589.
Pyrite (gross weight)	93,421	75,828	--	Romania 75,825.
Salt and brine	54	3,078	(1)	Hungary 3,073.
Sodium and potassium compounds, n.e.s	1,274	4,451	--	Turkey 1,000; France 746; India 600; Syria 500.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	49,745	50,151	--	Italy 26,206; Czechoslovakia 15,120.
Worked	6,252	4,254	--	West Germany 1,669; Austria 1,653.
Dolomite, chiefly refractory grade	1	--		
Gravel and crushed rock	57,238	5,195	--	Hungary 3,059; United Kingdom 545; Italy 423.
Limestone (except dimension)	10	3	--	All to West Germany.
Quartz and quartzite	9,767	13,056	--	Do.
Sand excluding metal-bearing	2,376	3,294	--	Greece 1,984; Albania 957; Libya 205.
Sulfur:				
Elemental, all forms	r3,826	6,543	--	Bulgaria 3,492; Turkey 1,768; Romania 1,130.
Sulfuric acid	1,192	162	--	Czechoslovakia 159.
Talc, steatite, soapstone, pyrophyllite	NA	590	--	All to Albania.
Other:				
Crude:				
Calcite	2,149	194	--	Pakistan 150; West Germany 44.
Unspecified	257	1,126	--	Greece 1,015; Austria 93.
Slag, dross, and similar waste, not metal-bearing	1,615	1,506	--	Austria 1,448; Italy 30; Lebanon 23.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	55	87	--	West Germany 86; Poland 1.
Coal and briquets:				
Anthracite and bituminous coal	940	--		
Lignite and lignite briquets	434,929	375,118	--	Austria 212,113; Czechoslovakia 102,139; Italy 39,714.
Coke and semicoke	148,596	307,538	--	Hungary 169,391; Romania 71,742; Austria 34,114.
Hydrogen, helium, rare gases	633	459	--	Austria 428; Egypt 12; Czechoslovakia 9.
Peat including peat briquets and litter	25	1,820	--	Italy 1,692; France 127.
Petroleum:				
Crude thousand 42-gallon barrels	(1)	--		
Refinery products:				
Gasoline do	r3,539	4,337	(1)	Switzerland 2,493; Netherlands 1,404.
Kerosine and jet fuel do	r405	448	8	Italy 158; United Kingdom 112; France 34.
Distillate fuel oil do	r2,383	584	1	Italy 281; Switzerland 141.
Residual fuel oil do	r309	269	(1)	Liberia 102; Greece 30.
Lubricants do	r340	349	--	Austria 278; Czechoslovakia 48.
Other:				
Liquefied petroleum gas do	r175	--		
White spirit do	33	6	--	All to Austria.
Mineral jelly and wax do	r44	46	3	West Germany 18; Italy 18.
Petroleum coke, pitch coke, bituminous mixtures do	40	43	--	West Germany 27; Poland 8; Italy 6.
Total do	7,268	6,082		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	20,293	36,727	2,304	Italy 29,404; Austria 3,580; West Germany 654.

rRevised. NA Not available.
1Less than 1/2 unit.

Table 3.—Yugoslavia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	43,643	63,883	--	Guinea 27,563; Greece 22,719; Australia 9,226.
Oxide and hydroxide	30,162	1,367	9	West Germany 1,274.
Metal including alloys:				
Unwrought	41,590	41,219	7	U.S.S.R. 30,996; West Germany 2,039.
Semimanufactures	9,538	8,510	26	West Germany 2,012; U.S.S.R. 1,652; France 1,589.
Antimony:				
Ore and concentrate	2,789	3,261	--	China, mainland 2,015; Turkey 850; Morocco 396.
Metal including alloys, all forms	145	--		--
Arsenic:				
Trioxide, pentoxide, acids	NA	66	--	West Germany 24; Belgium-Luxembourg 20; Netherlands 18.
Metal including alloys, all forms	36	138	(1)	U.S.S.R. 75; Austria 27; West Germany 26.
Beryllium metal including alloys, all forms kilograms	167	635	3	Denmark 500; West Germany 132.
Bismuth metal including alloys, all forms	18	5	--	Mainly from West Germany.
Chromium:				
Chromite	219,069	297,919	--	Albania 200,010; U.S.S.R. 84,072; Turkey 5,000.
Oxide and hydroxide	619	378	--	U.S.S.R. 300; West Germany 49.
Cobalt oxide and hydroxide	32	22	6	Belgium-Luxembourg 7; West Germany 5; Netherlands 2.
Columbium and tantalum including alloys, all forms kilograms	859	1,456	100	West Germany 1,219; Austria 68; Hungary 65.
Copper:				
Ore and concentrate	23,994	7,739	--	Mexico 7,352; Peru 387.
Copper sulfate	1,553	1,304	--	U.S.S.R. 1,298; Switzerland 3; West Germany 3.
Metal including alloys:				
Scrap kilograms	50	50	--	All from West Germany.
Unwrought	r40,061	36,095	2	Zambia 18,596; Peru 16,701.
Semimanufactures	8,469	5,414	7	West Germany 1,588; Poland 1,262; U.S.S.R. 1,193.
Iron and steel:				
Ore and concentrate thousand tons	547	1,060	--	India 365; Peru 355; U.S.S.R. 305.
Metal:				
Scrap	402,594	264,800	--	U.S.S.R. 238,257; Bulgaria 21,878; Poland 2,261.
Ingots	26,408	86,879	(1)	Poland 78,740; Romania 8,096.
Pig iron including cast iron	71,612	99,494	--	Spain 30,056; U.S.S.R. 27,647; East Germany 16,783.
Sponge iron, powder, shot	2,626	1,689	(1)	Sweden 1,502; France 77; West Germany 51.
Ferroalloys:				
Manganese	815	902	--	West Germany 623; France 279.
Other	6,584	7,083	79	West Germany 3,428; France 2,045.
Steel, primary forms:				
Blooms, billets, slabs, sheets, bars	581,773	464,937	--	Romania 167,692; Poland 97,579; Czechoslovakia 96,730.
Coils for recoiling	435,191	493,838	--	Czechoslovakia 134,601; U.S.S.R. 87,130; Bulgaria 60,016.
Semimanufactures:				
Bars, rods, angles, shapes, sections	278,601	204,194	10	Czechoslovakia 30,380; West Germany 28,089; Hungary 24,932.
Universals, plates, sheets	441,289	466,031	3	Czechoslovakia 90,360; West Germany 70,398; Austria 62,090.
Hoop and strip	90,270	104,811	70	West Germany 39,809; Poland 27,226.
Rails and accessories	7,482	59,123	136	West Germany 31,180; Austria 26,238.
Wire	30,145	36,288	5	West Germany 8,901; Austria 5,364.
Tubes, pipes, fittings	88,054	113,532	956	West Germany 19,626; France 18,813.
Castings and forgings, rough	2,198	3,438	1	Czechoslovakia 1,390; West Germany 874; France 480.
Lead:				
Ore and concentrate	5,623	1,978	--	All from Greece.
Oxide	3,084	3,365	5	Bulgaria 1,397; Austria 1,054; West Germany 401.
Metal including alloys:				
Scrap	NA	1,124	1,124	
Unwrought	8,192	9,539	--	Bulgaria 6,779; West Germany 1,364.
Semimanufactures	r110	97	(1)	Mainly to West Germany.
Magnesium metal including alloys, all forms	976	1,087	117	Norway 484; U.S.S.R. 433.

See footnotes at end of table.

Table 3.—Yugoslavia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate	96,346	115,041	--	Gabon 46,275; Botswana 40,864; U.S.S.R. 26,998.
Oxide	794	909	--	France 471; Belgium-Luxembourg 156; Ireland 130.
Mercury 76-pound flasks	230	301	--	China, mainland 300.
Molybdenum metal including alloys, all forms	18	16	--	Austria 12; United Kingdom 3.
Nickel metal including alloys:				
Scrap	10	2	--	Mainly from Austria.
Matte, speiss, similar materials	108	241	--	Mainly from Netherlands.
Unwrought	r1,486	1,507	--	U.S.S.R. 1,422; Italy 33; Canada 20.
Semimanufactures	r1,006	657	4	West Germany 266; U.S.S.R. 111.
Platinum-group metals including alloys, all forms:				
Platinum troy ounces	71,375	92,080	NA	U.S.S.R. 63,530; West Germany 13,825.
Other do	9,484	1,447	--	West Germany 1,029; France 257; United Kingdom 161.
Silicon, elemental kilograms	1,766	2,464	118	Italy 1,350; West Germany 804; United Kingdom 100.
Silver metal including alloys, all forms thousand troy ounces	1,475	869	(1)	Austria 292; West Germany 257; Italy 118.
Tin:				
Oxide	13	8	--	All from West Germany.
Metal including alloys:				
Unwrought	1,833	1,304	--	China, mainland 1,156; Malaysia 110.
Semimanufactures	36	53	(1)	West Germany 47; United Kingdom 3.
Titanium:				
Ore and concentrate	45,980	23,742	--	Australia 23,727; West Germany 15.
Oxide	2,578	1,420	--	West Germany 1,019; France 247; Belgium-Luxembourg 111.
Tungsten metal including alloys, all forms	23	25	(1)	China, mainland 8; Austria 5; Netherlands 3.
Zinc:				
Ore and concentrate	33,465	55,760	--	Peru 26,057; North Korea 17,956; Mexico 4,966.
Oxide	227	269	--	West Germany 268.
Metal including alloys:				
Unwrought	4,794	4,779	(1)	Zambia 4,749.
Semimanufactures	74	162	--	Italy 109; Netherlands 25; France 16.
Other:				
Ores and concentrates of vanadium, tantalum, zirconium	2,117	1,596	--	West Germany 763; Australia 760.
Ash and residue containing nonferrous metals	1,614	1,071	--	Switzerland 941; Italy 51; France 48.
Oxides, hydroxides, peroxides of metals, n.e.s	1,222	1,135	4	West Germany 699; Austria 130; U.S.S.R. 88.
Metals including alloys, all forms:				
Alkali, alkaline-earth, rare-earth metals	230	202	3	France 119; Italy 30; Austria 25.
Pyrophoric alloys	33	4	--	China, mainland 2; West Germany 1.
Base metals including alloys, all forms, n.e.s	615	744	142	Japan 155; West Germany 143; United Kingdom 112.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, natural corundum, etc	505	191	(1)	Denmark 92; Italy 58; West Germany 22.
Grinding and polishing wheels and stones	793	706	17	Austria 305; Italy 108; West Germany 83.
Asbestos	47,797	47,475	(1)	U.S.S.R. 25,599; Canada 10,504; Botswana 9,418.
Barite and witherite	1,206	1,204	--	West Germany 914; Czechoslovakia 240.
Boron materials:				
Crude natural borates	28,736	28,289	20,629	Turkey 7,350; Italy 250; Netherlands 60.
Oxides and acids	r373	723	--	U.S.S.R. 619; France 44; Austria 28.
Bromine	12	10	--	Israel 3; Japan 3; Netherlands 3.
Cement:				
Portland thousand tons	552	1,040	--	U.S.S.R. 370; Hungary 266; Romania 166.
Other	89,400	67,560	--	Bulgaria 63,288; West Germany 3,568.
Chalk	2,383	2,890	--	France 2,268; Austria 413; Switzerland 97.

See footnotes at end of table.

Table 3.—Yugoslavia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products including all refractory brick:				
Crude:				
Bentonite	16	19	--	Austria 17; United Kingdom 1.
Fire clay	35,610	38,771	827	Czechoslovakia 35,949; Austria 670; United Kingdom 641.
Fuller's earth, dinas, chamotte	5,442	2,294	56	Czechoslovakia 1,610; Poland 410; France 143.
Kaolin	73,464	75,804	2,896	Czechoslovakia 29,237; West Germany 12,685; U.S.S.R. 10,742.
Other	r8,661	16,946	21	Czechoslovakia 11,076; Poland 5,308.
Products:				
Refractory (including nonclay bricks)	40,928	37,119	8,346	West Germany 11,493; France 4,717.
Nonrefractory	27,487	23,233	(1)	Czechoslovakia 11,057; Italy 5,755.
Cryolite and chiolite	120	913	--	Denmark 890; Sweden 22.
Diamond:				
Gem, not set or strung carats	100,000	120,000	--	Bulgaria 50,000; Belgium-Luxembourg 40,000.
Industrial do	35,000	105,000	95,000	United Kingdom 10,000.
Powder kilograms	26	21	4	U.S.S.R. 9; Belgium-Luxembourg 6; United Kingdom 2.
Diatomite and other infusorial earth	152	285	48	U.S.S.R. 114; Austria 69; West Germany 32.
Feldspar	1,001	1,150	--	All from France.
Fertilizer materials:				
Crude:				
Nitrogenous	109	2	--	Do.
Phosphatic	902,610	896,443	--	Togo 440,198; Morocco 225,396; Jordan 85,622.
Other including mixed	--	23	--	All from Netherlands.
Manufactured:				
Nitrogenous	210,581	208,242	--	Hungary 66,465; U.S.S.R. 52,461; Czechoslovakia 38,101.
Phosphatic	47,089	48,804	--	Tunisia 35,738; Mexico 12,500.
Potassic	443,173	394,996	--	East Germany 239,419; U.S.S.R. 148,649.
Other including mixed	97,361	65,163	19,983	Romania 43,686; Poland 739.
Ammonia	65,908	95,946	1	Hungary 61,147; Romania 29,455; U.S.S.R. 4,654.
Fluorspar	r6,552	5,121	--	China, mainland 2,438; France 998; East Germany 900.
Graphite, natural	1,812	1,824	40	Czechoslovakia 678; Austria 526; East Germany 200.
Gypsum and plaster	9	8	--	West Germany 5; Italy 3.
Iodine	28	71	--	Japan 49; France 17.
Magnesite	r27,670	43,882	--	Greece 32,438; Turkey 6,000; Norway 3,460.
Mica:				
Crude including splittings and waste	716	1,177	(1)	India 733; Norway 241; West Germany 135.
Worked including agglomerated splittings	144	129	(1)	Czechoslovakia 45; Austria 34; Belgium-Luxembourg 25.
Pigments, mineral, iron oxides, processed	4,506	2,880	17	Hungary 909; West Germany 722; Spain 534.
Precious and semiprecious stones, except diamond:				
Natural kilograms	61	128	--	West Germany 83; China, mainland 38.
Manufactured do	483	701	--	Austria 302; Switzerland 234; France 124.
Pyrite, gross weight	19,126	124,227	--	U.S.S.R. 72,516; Cyprus 51,711.
Salt and brine	149,216	194,103	--	Romania 131,116; Tunisia 26,654; Spain 13,663.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	206,639	264,904	--	France 77,450; Italy 60,362; West Germany 30,330.
Caustic potash and sodic and potassic peroxides	120	203	(1)	Czechoslovakia 191; West Germany 6; Italy 6.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Calcareous	r325	2,871	--	Greece 2,820; Italy 51.
Slate	374	463	--	France 400; Austria 43; West Germany 20.
Other	r1,371	1,123	--	Italy 1,070; Sweden 46; West Germany 7.
Worked, not specified	197	327	--	Italy 322.

See footnotes at end of table.

Table 3.—Yugoslavia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory grade	947	1,563	--	Austria 999; United Kingdom 370.
Gravel and crushed rock	168,902	153,751	--	Hungary 152,168; West Germany 750.
Limestone except dimension	63,391	64,812	--	Hungary 59,753; Italy 5,059.
Quartz and quartzite	r18,324	13,470	111	West Germany 7,102; Greece 5,608.
Sand excluding metal-bearing	98,159	109,905	144	Italy 41,575; West Germany 27,040; East Germany 20,861.
Sulfur:				
Elemental, all forms	r60,934	67,720	--	Poland 65,901; Italy 1,175.
Sulfur dioxide	300	400	--	Mainly from Italy.
Sulfuric acid	84,857	88,225	(1)	Hungary 72,428; Austria 5,758; Romania 5,322.
Talc, steatite, soapstone, pyrophyllite	5,127	4,611	--	West Germany 1,480; Italy 664; France 650.
Other nonmetals, n.e.s.:				
Crude	14,127	16,606	297	Hungary 13,825; Austria 977; Switzerland 817.
Slag, dross, and similar waste, not metal-bearing	389,622	454,273	--	Italy 334,793; Romania 119,199.
Oxides and hydroxides of magnesium, strontium, barium	1,622	79	--	France 46; West Germany 28.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	6,610	2,188	149	Albania 1,000; Romania 996.
Carbon black and gas carbon	16,971	20,680	86	Italy 13,808; West Germany 3,355.
Coal and briquets:				
Anthracite and bituminous coal thousand tons	1,674	3,536	845	U.S.S.R. 1,758; Czechoslovakia 674; Poland 116.
Briquets of anthracite and bituminous coal do	1,379	--	--	
Lignite and lignite briquets	161,413	51,550	--	U.S.S.R. 46,639; East Germany 4,911.
Coke and semicoke	96,804	19,242	--	Italy 10,050; United Kingdom 8,514; West Germany 678.
Hydrogen, helium, rare gases kilograms	143,557	12,677	24	East Germany 4,386; Austria 3,068; Italy 2,524.
Peat including peat briquets and litter	16,518	13,514	--	U.S.S.R. 6,284; Hungary 4,746; Poland 2,398.
Petroleum:				
Crude thousand 42-gallon barrels	76,973	87,675	--	Iraq 43,392; U.S.S.R. 33,554.
Refinery products:				
Gasoline do	469	188	(1)	Czechoslovakia 114; Hungary 48; Italy 26.
Kerosine and jet fuel do	463	248	--	U.S.S.R. 178; Czechoslovakia 46.
Distillate fuel oil do	1,788	805	2	U.S.S.R. 792.
Residual fuel oil do	6,398	6,702	--	U.S.S.R. 3,877; Bulgaria 774; Italy 719.
Lubricants do	916	653	3	Italy 181; Hungary 108; Romania 91.
Other:				
Liquefied petroleum gas do	2,498	8,139	--	U.S.S.R. 7,148.
Mineral jelly and wax do	36	25	(1)	East Germany 8; West Germany 8.
Bitumen and other residues, n.e.s do	18	15	3	West Germany 8; Hungary 2.
Petroleum and pitch coke do	447	289	119	Albania 48; Bulgaria 41; U.S.S.R. 21.
Total do	13,033	17,064		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r43,405	47,566	60	Italy 17,399; U.S.S.R. 10,432; Hungary 7,984.

rRevised. NA Not available.
1Less than 1/2 unit.

COMMODITY REVIEW

METALS

Aluminum.—Expansion of the Titograd Aluminum Plant in Titograd, Montenegro, continued during 1980, and completion was foreseen in the first quarter of 1981. When completed, the plant should have an annual capacity of 100,000 tons of aluminum and 280,000 tons of alumina, approximately double its present capacity. Construction continued of the 92,000-ton-per-year aluminum plant at Bacevici near Mostar, BiH. Plans call for completion in early 1981.

Copper.—Development of the Veliki Krivelj copper deposit continued during the year. A recently published report indicated reserves at Veliki Krivelj to be about 702 million tons of ore, with an average copper content of 0.41%. The category of the reserves was not indicated. During 1980, most of the initial overburden was removed, and zones of mineralization were uncovered for a future planned production of 8 million tons of ore per year. Construction also started on a crushing and flotation plant to produce annually about 110,000 tons of copper concentrates, containing 25,000 tons of recoverable copper, which will be smelted at Bor, Serbia. Recovery of 60,000 tons of magnetite, with an average content of 62% iron; 250,000 tons of pyrite; and 200 tons of molybdenum was also planned, in addition to unspecified quantities of gold, silver, platinum, palladium, selenium, and rhenium. Regular ore production at Krivelj was scheduled for the latter part of 1981.

At Bor, a new shaft, 540 meters deep, was completed. The new haulage system at Bor was designed to move 4.5 million tons of materials per year.

At Bucim in Macedonia, the first year of regular production of copper ore and concentrates was below expectation because the grade of ore was far lower than expected. A decision was thus made to switch production to a new and richer ore body.

Chromite.—Hopes were expressed that reserves of chromite at Vitina Padina on Sara Mountain in Macedonia, reported at 3 million tons, would ultimately make unnecessary continued imports for the Jegunovci ferroalloy plant. However, no further details as to grade of ore or prospective startup date for mining were available.

Iron and Steel.—The iron and steel industry had an uneventful year. Development of a 2-million-ton-per-year iron ore mine at Omarska, BiH, continued. The mines at Vares and Ljubija operated by Rudarsko Metalurski-Kombinat-Zenica (RMK-Zenica) remained the largest producing iron ore mines in the country. Recovery of magnetite at the Majdanpek copper flotation plant was small, but new facilities for recovery of magnetite at the new copper flotation plant at Krivelj, when completed, should add another 60,000 tons per year of high-grade 62% iron magnetite concentrates and make byproduct magnetite a better domestic source of iron. Some of the domestic iron ores produced in Yugoslavia run as low as 27% iron.

Yugoslavia remained a net importer of iron ore in 1979, the latest year for which complete trade data were available, but the domestic production supplied almost 81% of the country's demand.

Ferroalloys.—The ferroalloy industry of Yugoslavia exported about two-thirds of its output during 1980. The following producers were in operation at the beginning of 1980: Elektrobosna at Jajce, BiH; Tvornica Elektroda i Ferolegura, Sibenik, Croatia; Tvornica Dalmacija, Dugi Rat, near Split, Croatia; Tovarna Dusika Ruse, near Maribor, Slovenia; and Kombinat Jegunovci.

At Tovarna Dusika Ruse, a new 20-megawatt ferrosilicon furnace started production in the fall, making a total of six furnaces in operation at Tovarna Dusika Ruse.

At Kosovska Kamenica, Kosovo, Serbia, a decision was made to build a plant for a yearly production of 33,000 tons of ferrosilicon and 25,000 tons of silicon metal. The new plant will be supplied with high-grade quartzite from a new mine located in the vicinity of Kosovska Kamenica.

Steel.—Modernization of the steel plant, Zeljezara Boris Kidric in Niksic, Montenegro, continued. It is the fifth year since the beginning of reconstruction. When completed, the plant should have a capacity of 315,000 tons of steel per year.

Two of the four blast furnaces in RMK-Zenica were shut down for repairs during 1980. One blast furnace came back on-stream at yearend.

The management of the steel plant at Sisak, Croatia, the largest producer of seamless pipes in the country, was planning to build new facilities to produce 200,000 tons of seamless pipes.

At the country's largest producer of welded pipes,II Oktomvri in Kumanovo, a plant was under construction for annual production of 170,000 tons of pipes, profiles, and shapes. When expansion is completed, total capacity of II Oktomvri should be 300,000 tons of fabricated steel products.

Plans were announced for expansion of the capacity of the steel plant at Skopje, Macedonia, to 950,000 tons of steel, up from the present 500,000-ton level.

Lead and Zinc.—During 1980, the lead and zinc sector of the minerals industry faced problems of lagging mine output resulting from mining low-grade ores, with low recovery of metals. Yugoslavia imported about 50,000 tons of zinc concentrates and smaller quantities of lead concentrates

during 1979, the latest year for which trade figures were available, indicating that the country may be becoming less than self-sufficient. During 1980, however, efforts were made to increase domestic mine production. The Trepca Mine in Kosovo, Serbia, and the mines in Blagodat, Kisnica, and Novo Brdo, Rudnik, Srebrenica, were also planning higher output, but faced difficulties in securing adequate financing. Development of the recently discovered Veovaca Mine near Vares in BiH continued. Tailings of some mines were also assayed, and their metal content indicated some possibility of economic recovery of lead and zinc. In the past, significant quantities of metals were lost because of low recovery during beneficiation.

The Belgian company, Mechim, and RMHK Trepca signed a contract for modernization and expansion of Trepca's electrolytic zinc plant at Kosovska Mitrovica, Kosovo, Serbia. The contract, worth more than 1.5 billion Belgian francs (about US$500 million), provides for use of "Super Jumbo" electrolysis bays developed by Vieille-Montagne. Mechim was to provide design of the process and supply of equipment, as well as technical assistance. Norzinc, a Norwegian company, was to provide technology for the processing of residues. The Société Générale de Banque provided financing. The so-called Super Jumbo technology uses cathodes of 2.6-square meters immersed surface area, with a high-power density, thus saving about 55% of the area used, and reducing the weight of cathodes by 8%.

Magnesium.—Production began at the first Yugoslavian magnesium plant, Bela Stena, near Baljevac na Ibru, Serbia. Annual capacity was reported at 5,000 tons of 99.8% magnesium.

The plant uses the Magnetherm process of the Société Francaise d' Electrometallurgie, which also gave technical assistance in bringing the plant into production.

Nickel.—Construction of Feni's nickel mine and a 16,000-ton-per-year contained nickel ferronickel plant at Rzanovo near Kavadarci, Macedonia, continued. At Glogovac in Kosovo and Methohija, Serbia, respectively, another nickel mine and a 12,000-ton-per-year contained nickel plant were under construction. The Rzanovo facility was slated for production in 1980, but financial problems caused a delay until 1981. The Glogovac facility was planned to come onstream in 1983 or 1984.

Other Metals.—As shown in table 1, Yugoslavia produced a number of byproducts of copper and lead-zinc production. Bismuth was a byproduct of lead and zinc output at Trepca, Serbia, and at Titov Veles, Macedonia; cadmium was produced at Trepca's plant at Kosovska Mitrovica and at Zorka's plant at Sabac. The Bor complex recovered gold, germanium, platinum, palladium, selenium, and silver as byproducts of its copper production. Trepca's smelter at Zvecan was the main source of silver, a byproduct of lead processing.

NONMETALS

Ammonia.—Two new ammonia plants were under construction in Yugoslavia during 1980. One plant at Pancevo was planned for an annual output of 280,000 tons by 1982. A 369,000-ton-per-year plant, to be completed by 1981, was also under construction at Kutina, Croatia, as part of the Industrija Nafte's (INA) petrochemical project. Both plants will use natural gas feedstock.

Asbestos.—Humboldt Wedag AG of the Federal Republic of Germany was awarded a contract for supplying equipment for an asbestos ore preparation plant at Stragari, Serbia. No further details were made public. A mine owned by Bosna Asbest, located near Bosanski Petrovac in BiH, was the largest producer of asbestos in the country. Yugoslavia remained a net importer of asbestos, and more than four-fifths of its demand was met through imports.

Barite.—On Bobija Mountain, near the town of Ljubovija in Serbia, several years of exploration confirmed existence of important deposits of barite. If investment capital can be found, a 150,000-ton-per-year mine was planned. Completion of the mine and plant would require 3 years from the date of the beginning of construction.

Cement.—At the cement plant located in Kosjeric, Serbia, experiments were conducted to use fly ash from the Kolubara powerplants in the production of cement. About 100 tons of cement was produced during 1980, and regular production was planned for the spring of 1981.

At Bela Palanka, Serbia, an 800,000-ton-per-year cement plant, to be in operation by 1983, was planned. At yearend, about 75% of the capital for construction was assured. In Podrutama, near Zagreb, Croatia, a 2-million-ton-per-year cement plant was planned in two stages of construction, each with 1 million tons of capacity. Startup was also scheduled for 1983.

Quartz.—The Opalit enterprise started

development of a quartz mine and beneficiation plant at Lokavica, near Casinovo in the general area of Stip, Macedonia, to be completed in 1981. Mine production was planned at 250,000 tons per year of quartz sand, which would yield about 45,000 tons of high-quality beneficated quartz.

Salt.—At Majevica Mountain, in BiH, a new salt deposit was discovered at a depth of around 800 meters; thickness varies from 22 to 190 meters. Four drill holes, all positive, were located near the village Teti on the southern slopes of Majevica Mountain. If additional drilling indicates a mineable deposit, development may start in 1985.

MINERALS FUELS

High prices for imported crude oil and natural gas continued to heavily tax Yugoslavia's balance of payments during 1980. Exploration was thus intensified for domestic coal, petroleum, natural gas, and uranium; plans were prepared to build new hydropower installations; and as many as 16 thermoelectric facilities were considered for completion by 1985. Development of oil shale deposits and expanded lignite beneficiation facilities were studied. Yugoslavia, meanwhile, remained dependent on imported high-rank coals, crude oil, and natural gas to meet its energy demand. Low-rank coals, mostly lignites, were the principal energy source produced in the country during 1980.

Coal.—It was planned to increase coal production to 82 million tons in 1985, about 37 million tons more than in 1980. Exploration and investment were stepped up, but labor shortages and financing difficulties prevented reaching planned objectives.

In Slovenia, the most productive mine in the Zasava Coal Basin (Zasavski Revir), near Hrastnik, Ojstre, was out of production for 3 months because of a cave-in and flooding. The mine was expected to reach its preflood production of 900 tons of coal per day some time in 1981 when new mining equipment purchased in France would be operational. In BiH, the State with the largest production of brown coal in Yugoslavia, new brown coal reserves were discovered at Moscanica, near Zenica. Apparently, the new coal deposit is an extension of the nearby Kakanj Coal Basin. Proven coal reserves in the new field amounted to 60 million tons, with a calorific value of 6,000 kilocalories per kilogram. In 1984, preparation for starting up a 500,000-ton-per-year mine at Moscanica will begin, if capital is available. In the Mostar Coal Basin, BiH, near Mostar, Lisana-Bijelo Polje, a 120-million-ton brown coal deposit was delineated, and work started on opening of a new mine, which will appreciably extend the life of the Mostar Mine.

About 70 million tons of brown coal are found in the area between the localities of Maglaj and Zepce in BiH. A mine was to be established there, to supply the Natronka paper bag factory at Maglaj now using residual oil. Work continued on exploration and preparation for production at the Juzna Sinklinala deposit, located near Tuzla, BiH. The new 3-million-ton-per-year opencast mine was planned to start production in 1986.

In Serbia, the largest coal producing State in Yugoslavia, the most important development was the confirmation of reserves of about 90 million tons of lignite near Kovin, in Banat, Serbia. Reports also indicated possible reserves in the region of up to 200 million tons of lignite. Important deposits of solid fuels had not been known in Banat, but a mine and thermal powerplant near Kovin were being considered. In addition, a lignite deposit was discovered on Fruska Gora Mountain, between Beocin and Suseka near Novi Sad, Serbia. Proven reserves were reported at 100 million tons of lignite, with calorific values between 1,600 and 2,000 kilocalories per kilogram.

In the Kolubara Basin, after earlier start-up of the mines at Tamnava, a new opencast mine, Tamnava West, went onstream in August 1980. Plans called for an output of 18 to 20 million tons of lignite from the two Tamnava mines by 1985. Most of the production was to be used by powerplants situated, or to be built, near Obrenovac, Serbia.

At the Kostolac lignite basin, near Kostolac in Serbia, the 2.5-million-ton-per-year Cirkovac opencast mine started trial production at yearend. During the year, work on the Drmno coal deposit nearby continued, and a new opencast mine with an annual capacity of 6 million tons should be in production there by 1986, with an additional 3 million tons planned for 1990. Plans also called for the opening of a new mine at Poljani near Pozarevac and the reopening of an old mine at Melnica near Petrovac.

In Macedonia, which recently became a coal producer, exploration in the Pelagonian coal basin lead to the discovery of three lignite deposits. The largest, with proven reserves of 200 million tons, is near Suvodol,

about 20 kilometers northeast of Bitola. A mine at Suvodol and two thermal powerplants nearby were under construction in 1980.

Natural Gas and Petroleum.—In 1980, imports equal to about 70% of crude oil demand and to about 20% of natural gas demand were necessary. In an effort to assure a supply of crude oil from abroad, Yugoslavia's petroleum-producing enterprises explored for oil in Africa, Italy, and Bangladesh, and a contract for exploration in Indonesia was concluded during 1980.

The Pannonian Basin, located in the northern part of the country, remained the principal area of activity in exploration and production of liquid and gaseous hydrocarbons. In Croatia, new discoveries of gas were announced at Stari Gradec, near Pitomaca. In addition, the oilfield at Stekovica, Croatia, was expanded. The large gasfield at Molve near Durdevac, Croatia, started production officially at yearend. Initial production was planned to reach 300,000 million cubic meters of natural gas per year. It took Naftaplin-INA, the operating company, 7 years and 2.3 billion dinars to develop and equip this field. A smaller gasfield also went onstream at Obradovci, Croatia, with a possible output of about 9 million cubic meters of natural gas per year.

Exploration offshore in the Adriatic Sea continued. Reports indicated an offshore gas discovery in a well in the northern Adriatic, in the general area of Pula, Croatia, drilled by Naftaplin's offshore rig Panon. No other details were made public. In the southern Adriatic between Boka Kotorska and Ulcinj, Montenegro, seismic work was in progress all summer. Although two offshore wells were dry, the partners of the venture, Butes Gas, Chevron, and Yugopetrol, hoped that results of seismics would justify drilling a third well in the southern Adriatic. According to unconfirmed reports, Naftaplin will request bids for joint ventures with foreign oil companies in offshore Adriatic waters sometime early in 1981.

In Serbia, a new oilfield near Banatsko Karadjordjevo started production during the summer; production plans called for a yearly output of 60,000 tons of crude oil.

Construction continued on a 2.5-million-ton-per-year petroleum refinery near Skopje in Macedonia. Reportedly, first production was to start in 1981. In Modric, a new refinery for production of 60,000 tons per year of lubricating oil, and 20,000 tons of paraffin was brought onstream during the summer by Energoinvest of Sarajevo.

The pipeline in eastern Yugoslavia, connecting Horgos at the Hungarian border with Novi Sad, Beocin, Pancevo, and Zvornik, went onstream during the year, supplying domestic and Hungarian natural gas.

The pipeline connecting the oil terminal at Omisalj on the Adriatic Sea with domestic inland refineries and with Hungary was filled with crude oil, and the oil reached the more distant refineries in Lendava and Pancevo during 1980. About 300,000 tons of the crude oil were pumped to Hungary.

Uranium.—Construction of the first Yugoslav nuclear powerplant at Krsko Slovenia (615 megawatts electrical) continued during 1980. In the fall, the Krsko plant passed successfully a "hot functional test." Plans called for core loading in March 1981 and 100% power to be reached in September 1981.

The development of a uranium mine and construction of a yellow cake plant continued at Zirovski Vrh, Slovenia. Production should start in 1981. Development of the mine commenced in the early 1960's, but was hampered by environmental concerns. Flour Mining and Metal Inc. (Flour) performed the technical design of the project. During the latter part of 1980, Flour was purchasing process and instrumentation equipment. When completed by early 1981, the mill will process 210,000 tons of uranium ore and produce 600,000 pounds (272 tons) of uranium oxide per year. The plant was located in an area with a high population density, with permeable geology and heavy rain and snowfall. Reportedly, water runoff and subterranean water from the plant and tailings could contaminate the water supply for the surrounding area and for the nearby large city of Ljubljana. The treatment plant is designed to contain all liquors within the facility, hoping to eliminate liquid effluent which could contaminate the environment. The Jozef Stefan Institute (IJS) of Ljubljana developed the completely closed-circuit operation.

The basic process used in the mill at Zirovski Vrh is leaching with sulfuric acid. A novelty included is a patented process developed by the IJS ensuring almost total elimination of magnesium without use of the expensive high alkalinities normally used for cation removal.[3]

In Serbia, near Kalna, indications of new uranium mineralization were discovered near localities at Radicevac, Papratni,

and near Adinska Reka in eastern Serbia. A uranium mine and plant were formerly operated at Kalna by political prisoners, but both are now closed.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Yugoslav dinars to U.S. dollars at a rate of 30 dinars=US$1.00.

[3]Engineering and Mining Journal. V. 182, No. 3, March 1981, pp. 35, 39.

The Mineral Industry of Zaire

By Miller W. Ellis[1]

In 1980, Zaire's mineral industry provided 85% of the country's foreign exchange and maintained its position as the world's leading producer of industrial diamonds and cobalt, and the world's sixth largest producer of copper. Despite high transport costs, shortages of skilled labor and fuel, and a diminishing price for copper, production of most of Zaire's mineral commodities increased as the industry resumed normal operations after the armed invasion of the Shaba Region in 1978, and after the higher metal prices of 1979.

The Government of Zaire (GOZ) declared a 30% devaluation of the national currency, the Zaire (Z), on February 22, 1980, following the 25% devaluation of August 1979. The measure was designed to comply with conditions set down by the International Monetary Fund (IMF) to which the central government had appealed for economic assistance. The result was a reduction of the worth of the Z to about 34 cents, U.S. currency, or Z2.94=US$1.00, by yearend. A rescheduling agreement with Zaire's international bank creditors was signed in April 1980, and the International Bank for Research and Development (IBRD) consultative group met in late May. Zaire's debt-servicing payments for 1980 were estimated at $470 million, compared with only $120 million in 1979. By the end of September, the GOZ had met the IMF standby conditions and had maintained the rigorous budget deficit and credit ceilings as agreed. It had also adhered to the 1980 repayment terms and the rescheduled public and private debt reimbursement of $300 million (three times the total of debt repayment for 1979). There was also a signal improvement in the GOZ attitude towards general development programs, particularly those with respect to health and agriculture.

In mid-January 1980, President Mobutu Sese Seko requested resignations from 13 of his 22 cabinet ministers and reassigned some of the others. Prime Minister Nguza Karl-I-Bond retained his post, but a former opposition leader, Kamitatu Massambwa, became Minister of Environment and Tourism. General Babia Nzongbi Malobia, formerly chief of the armed forces, became Minister of Social Affairs. Magazba Mbuka was appointed Commissioner for Mines, but was replaced by Lwamba Katansi on August 27, 1980.

More than one-half (53%) of the 1979 export traffic was carried on the river barge and rail Voie National and shipped from Matadi. Of the 39% of traffic shipped through South African ports, 8% took the barge route across Lake Tanganyika, and the Tanzanian railway to Dar es Salaam. During early 1980, virtually all cobalt was shipped by air, 51% of the copper was railed to South African ports, 46% was shipped to Matadi by the Voie National, and 3% was shipped through Tanzania to Dar es Salaam. Less than 10% of the tin shipments also went through Tanzania to Dar es Salaam, and more than 90% went by the Voie National to Matadi.

Studies of the Banana-Boma-Matadi section of the Zaire River Bay continued as did examination of proposals for improvement of river barge and rail transport within the country. Electrification of the Matadi-Kinshasa railroad was scheduled for 1981. Operation of the 615-millimeter-gauge Mayumbe railroad from Boma, 140 kilometers north to Tshela near the bauxite deposits, was halted. Alternative routes for a rail link between Matadi or Kinshasa and the copperbelt terminal at Ilebo were restudied, and a schedule for the repair of internal road transport routes was initiated.

The target date for completion of the Inga-Shaba DC power transmission lines and the two massive inverter stations was reestimated as mid-1982 by the U.S. Constructeurs Inga Shaba (CIS) officials at their Kolwezi terminal base. Potential demand was lower than had been anticipated in 1976, mostly because of uncertainty over reduced requirements from the installed 560-megawatt capacity.

PRODUCTION AND TRADE

All of Zaire's cadmium, cobalt, zinc, most of its copper, and a substantial share of its gold and silver were produced by the giant Government-owned firm La Générale des Carrieres et des Mines du Zaire (Gécamines) from their three operating centers at Kolwezi, Likasi, and Lubumbashi in the Shaba Region of southeastern Zaire. The remainder of Zaire's copper was produced by the Société de Développement Industriel et Minière du Zaire (Sodimiza), owned 80% by a Japanese consortium and 20% by the GOZ. Sodimiza operated two mines and the Musoshi concentrator near the Zambian border southeast of Lubumbashi. Its copper concentrates were railed to a South African port for shipment to Japan for smelting.

A preliminary estimate of Zaire's balance-of-payment status for 1980 indicated that the dollar value of imports had increased to $2,509.5 million, and exports totaled $2,209.5 million. The principal exports were copper at $898.1 million, cobalt at $529.0 million, diamonds at $256.3 million, petroleum at $60 million, silver at $55.5 million, tin at $42.8 million, gold at $32.6 million, and zinc at $13.0 million, with mineral exports totaling $1,897.3 million. The principal agricultural export was coffee valued at $208.8 million.

The Sino-Zairian cooperation agreement was reaffirmed in February when the Zairian marketing agency, Société Zaircise de Commercialisation des Minerais (Sozacom), arranged for a delegation from the China National Metals & Minerals Import & Export Corp. to purchase 20,000 tons of copper and 250 tons of cobalt from Gécamines in 1980. A joint statement by the Zairian and Zambian authorities in February 1980 assured their customers of a regular and stable supply of cobalt for the remainder of the year at a price of $25 per pound. On July 7, 1980, Sozacom announced the abandonment of the 70% sales allocation of cobalt in force since May 1, 1978.

In mid-September, Sozacom's director led a delegation to the United States to discuss arrangements for long-term direct sales of cobalt with end users, and bulk sales with the General Services Administration cobalt stockpile authorities. There was little demand for cobalt at the producer price of $25 per pound, and the spot price for cobalt subsequently dropped to $23 and finally to $18 per pound. The U.S. Department of Commerce arranged for a mining trade mission which visited Lubumbashi in the latter part of October 1980.

The 1979 surge in cobalt and copper prices raised Gécamines' revenues to $1.5 billion for the year, of which 45%, or $677 million, would have been available to Gécamines as foreign exchange. Actually, about $135 million reportedly remained in the hands of Kinshasa officials, and $542 million was available to Gécamines. In March 1980, the GOZ announced that it would retain Gécamines' foreign funds and disburse specific amounts to meet specific needs when requested.

Details of Zaire's mineral products are shown in table 1. Apparent exports and apparent imports of mineral commodities are listed in table 2 and table 3, respectively.

Table 1.—Zaire: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
METALS					
Cadmium, smelter	266	246	186	212	[2]168
Cobalt:					
Mine output, metal content[e]	11,000	10,200	13,300	15,000	15,500
Refined	10,696	10,215	13,125	14,100	[2]14,700
Columbium-tantalum concentrate	79	83	18	32	[2]92
Copper:					
Mine output, metal content	444,432	481,550	423,800	399,584	[2]459,392
Blister and leach cathodes	413,000	443,000	390,700	370,100	[2]425,745
Refined	66,018	98,708	102,797	103,214	[2]144,161
Gold[3] troy ounces	91,093	80,418	76,077	69,992	[2]39,963
Iron and steel: Crude steel[e]	30,000	30,000	NA	NA	NA
Manganese ore and concentrate	182,184	41,019	--	--	[2]16,586
Monazite concentrate, gross weight	240	97	77	90	[2]51
Silver thousand troy ounces	2,472	2,730	4,391	3,892	[2]2,733
Tin:					
Mine output, metal content	3,776	5,073	4,390	3,879	3,000
Smelter, primary	478	765	496	458	[2]458
Tungsten, mine output, metal content	237	170	148	112	[2]72
Zinc:					
Mine output, metal content	67,800	73,000	73,700	68,000	67,000
Metal, primary, electrolytic	61,677	51,049	43,500	43,508	[2]43,800
NONMETALS					
Cement, hydraulic thousand tons	[e]655	489	472	450	400
Diamond:					
Gem[e] thousand carats	[r]498	[r]533	[r]640	[r]294	345
Industrial[e] do.	[r]11,323	[r]10,681	[r]10,603	[r]8,440	9,890
Total do.	11,821	[r]11,214	11,243	8,734	[2]10,235
Lime	[e]110,000	101,155	[e]100,000	[e]100,000	100,000
Sulfur:					
Byproduct of metallurgy, S content of sulfuric acid produced	37,200	30,700	[e]30,000	[e]30,000	30,000
Sulfuric acid, gross weight	NA	151,423	NA	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	100	128	107	100	[2]138
Petroleum:					
Crude thousand 42-gallon barrels	9,075	8,255	6,604	7,535	7,500
Refinery products:					
Gasoline do.	579	275	279	483	NA
Kerosine and jet fuel do.	318	142	231	319	NA
Distillate fuel oil do.	698	320	289	682	NA
Residual fuel oil do.	878	351	529	1,252	NA
Liquefied petroleum gas do.	12	15	--	21	NA
Refinery fuel and losses do.	245	110	125	[4]173	NA
Total do.	2,730	1,213	1,453	2,930	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through June 16, 1981.

[2]Reported figure.

[3]Excludes gold recovered from blister copper.

[4]Reportedly includes 75,000 barrels of unfinished oil shipped elsewhere for future refining.

Table 2.—Zaire: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum metal including alloys, scrap	--	35	Belgium-Luxembourg 34.
Cadmium metal including alloys, all forms	185	101	Belgium-Luxembourg 76; United States 25.
Cobalt:			
Oxide and hydroxide	--	10	All to United States.
Metal including alloys, all forms	4,407	4,771	United States 3,984; West Germany 464; Sweden 194.
Copper:			
Ore and concentrate	102,144	94,864	Japan 94,863.
Metal including alloys:			
Unwrought:[3]			
Blister	301,290	266,164	Belgium-Luxembourg 249,733; France 16,431.
Refined	103,645	70,041	Brazil 17,465; Italy 12,600; Japan 12,471; France 8,451.
Semimanufactures	16	2,471	All to United States.
Iron ore and concentrate	--	1,114	All to Belgium-Luxembourg.
Lead metal including alloys:			
Scrap	--	45	All to Italy.
Unwrought	NA	27	All to Nigeria.
Manganese ore and concentrate	59,614	39,107	Belgium-Luxembourg 36,714; United Kingdom 2,177.
Silver metal including alloys, unwrought or wrought, value, thousands	$37	$54	All to Belgium-Luxembourg.
Tin:			
Ore and concentrate	3,477	1,923	Do.
Metal including alloys, unwrought	1,139	544	Belgium-Luxembourg 379; France 165.
Tungsten ore and concentrate	249	161	United States 72; France 37; West Germany 21; Japan 20.
Zinc metal including alloys, unwrought	[3]40,900	[3]30,800	United States 14,880; Brazil 3,727; Greece 2,615.
Other:			
Ore and concentrate	134	39	Japan 30; United States 6.
Ash and residues, nonferrous	225	467	West Germany 308; Belgium-Luxembourg 159.
Base metals including alloys, all forms, n.e.s	2,053	51	Switzerland 28; Yugoslavia 15.
NONMETALS			
Abrasives: Dust and powder of natural and synthetic precious and semiprecious stones, value, thousands	$2,346	$1,820	Japan $1,151; United States $595.
Cement	9,916	8,172	All to Central Africa.
Diamond:			
Gem, not set or strung, value, thousands	$2,226	$3,109	Belgium-Luxembourg $2,083; Australia $1,011.
Industrial, do	$8,230	$12,729	United States $7,547; West Germany $2,971.
Precious and semiprecious stones except diamond:			
Natural, do	$3,195	$845	Switzerland $288; United States $130; Thailand $82; United Kingdom $79; Hong Kong $75.
Synthetic, do	$2	$5	Thailand $4.
MINERAL FUELS AND RELATED MATERIALS			
Coal, anthracite and bituminous	--	18,287	All to Belgium-Luxembourg.
Petroleum:			
Crude or partly refined, thousand 42-gallon barrels	248	1,514	All to United States.
Refinery products:			
Residual fuel oil, do	--	431	Sweden 292; France 139.
Other: Liquified petroleum gas, 42-gallon barrels	NA	23	All to Central Africa.

NA Not available.

[1]Owing to the lack of available official trade data published by Zaire, this table should not be taken as a complete presentation of Zaire's mineral exports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Unless otherwise specified, data are compiled from trade statistics of individual trading partners.

[3]World Bureau of Metal Statistics. World Metal Statistics, London, November 1980.

Table 3.—Zaire: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Oxide and hydroxide	215	42	United Kingdom 40.
Metal including alloys, semimanufactures	321	626	Hong Kong 308; Belgium-Luxembourg 150.
Copper metal including alloys, semimanufactures	148	154	Belgium-Luxembourg 90; Italy 60.
Iron and steel metal including alloys:			
Scrap	--	43	All from United States.
Pig iron	5,271	97	France 51; Belgium-Luxembourg 46.
Ferroalloys	96	117	Italy 95.
Semimanufactures:			
Bars, rods, angles, shapes, sections	7,870	11,105	Belgium-Luxembourg 8,215; Spain 1,393.
Plates and sheets	22,028	23,758	Belgium-Luxembourg 10,134; Japan 8,482.
Hoop and strip	904	757	Belgium-Luxembourg 638.
Rails and accessories	58	2,325	Belgium-Luxembourg 2,244.
Wire	725	577	Belgium-Luxembourg 445; Italy 95.
Tubes, pipes, fittings	9,213	5,817	Belgium-Luxembourg 1,493; West Germany 1,202; France 824.
Castings and forgings	1,780	428	Italy 375; Belgium-Luxembourg 53.
Lead:			
Oxide	40	46	France 30; United Kingdom 16.
Metal including alloys:			
Unwrought	280	433	Belgium-Luxembourg 363; United States 50.
Semimanufactures	6	20	West Germany 11; Belgium-Luxembourg 6.
Magnesium metal including alloys, semimanufactures	NA	5	All from United Kingdom.
Manganese oxides	801	103	All from United States.
Nickel metal including alloys:			
Unwrought	--	1	All from Belgium-Luxembourg.
Semimanufactures	--	(3)	All from Switzerland.
Platinum-group metals including alloys, worked or partly worked, value, thousands	$1	$7	Do.
Silver metal including alloys, worked or partly worked, do.	$147	$98	Switzerland $90.
Tin metal including alloys, unwrought	1	1	Do.
Titanium oxides	1	4	All from United Kingdom.
Zinc:			
Oxide and peroxide	58	20	United States 10; Belgium-Luxembourg 7.
Metal including alloys, semimanufactures	39	21	All from Belgium-Luxembourg.
Other:			
Metalloids	143	251	All from France.
Base metals including alloys, all forms, n.e.s	NA	2	Belgium-Luxembourg 1; United Kingdom 1.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc	1	7	Italy 6.
Dust and powder of natural and synthetic precious and semiprecious stones value, thousands	--	$2	All from Belgium-Luxembourg.
Grinding and polishing wheels and stones	76	56	Italy 21; Belgium-Luxembourg 15; West Germany 10.
Asbestos	929	554	All from Canada.
Barite and witherite	15	2,500	All from Morocco.
Cement	1,914	1,282	Belgium-Luxembourg 1,225.
Chalk	49	175	Belgium-Luxembourg 59; Italy 59; France 57.
Clays and clay products:			
Crude:			
Bentonite	50	272	All from United States.
Other	8	12	All from Belgium-Luxembourg.
Products:			
Refractory	2,605	2,695	Austria 1,843; West Germany 533.
Nonrefractory	2,911	2,645	Spain 995; Italy 840; Belgium-Luxembourg 500.
Diamond:			
Gem, not set or strung value, thousands	$136	$5	All from France.
Industrial do.	--	$3	All from United States.
Diatomite and other infusorial earth	84	91	France 82.
Feldspar and fluorspar	50	440	United Kingdom 250; Spain 110.
Fertilizer materials:			
Crude, phosphatic	NA	151	All from Belgium-Luxembourg.
Manufactured:			
Nitrogenous	8,481	6,586	France 4,348; West Germany 1,003; Netherlands 775.
Phosphatic	396	5	All from Belgium-Luxembourg.
Potassic	85	484	Do.
Other including mixed	10,365	5,135	West Germany 2,423; Belgium-Luxembourg 1,194; France 1,119.
Ammonia	127	124	Belgium-Luxembourg 118.
Gypsum and plasters	5,436	4,761	Morocco 4,750.
Lime	1,750	1,661	Belgium-Luxembourg 1,647.
Magnesite	3	120	Austria 90; Canada 28.
Mica, crude	7	5	All from United States.

See footnotes at end of table.

Table 3.—Zaire: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
NONMETALS —Continued			
Pigments, mineral: Processed iron oxides	84	45	All from West Germany.
Salt	908	1,100	Portugal 627; West Germany 200; Spain 120.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	1,858	4,122	Spain 1,442; West Germany 1,150; Belgium-Luxembourg 711.
Caustic potash	215	11	Belgium-Luxembourg 8; France 3.
Soda ash	1,938	851	France 600; United Kingdom 251.
Stone and sand and gravel:			
Dimension stone, worked	156	164	Italy 88; Portugal 71.
Gravel and crushed rock	22	28	West Germany 23.
Quartz and quartzite	10	2	All from West Germany.
Sand excluding metal-bearing	3,089	33	Netherlands 26.
Sulfur:			
Elemental, other than colloidal	114	30	West Germany 23.
Sulfuric acid	356	135	Belgium-Luxembourg 131.
Talc	55	131	Belgium-Luxembourg 43; West Germany 38; Israel 30.
Other nonmetals, n.e.s.:			
Crude	18	25	West Germany 20.
Halogens	3	1	All from United Kingdom.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	74	52	Belgium-Luxembourg 40.
Carbon black	718	482	United Kingdom 238; Netherlands 156.
Coal, anthracite and bituminous including briquets	549	89	All from Italy.
Lignite and lignite briquets	16	52	All from United States.
Petroleum:			
Crude or partly refined thousand 42-gallon barrels	1,481	(4)	All from Saudi Arabia.
Refinery products:			
Gasoline do	542	726	Brazil 720.
Kerosine do	609	1,135	Brazil 1,134.
Distillate fuel oil do	913	1,136	Brazil 1,135.
Residual fuel oil do	NA	10	All from Ivory Coast.
Lubricants do	294	167	France 132; Belgium-Luxembourg 14.
Other:			
Liquified petroleum gas 42-gallon barrels	58	35	All from Belgium-Luxembourg.
Mineral jelly and wax do	4,336	2,668	West Germany 992; United Kingdom 803; Belgium-Luxembourg 724.
Bitumen and other residues do	25,451	12,072	Spain 11,120.
Bituminous mixtures do	12,218	4,818	Spain 3,848; Belgium-Luxembourg 861.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	95	111	Belgium-Luxembourg 77; Portugal 20.

NA Not available.

[1] Owing to the lack of available trade data published by Zaire, this table should not be taken as a complete presentation of Zaire's mineral imports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2] These data are compiled from trade statistics of individual trading partners.

[3] Less than 1/2 unit.

[4] Value only reported at $23,549,000; the 1978 quantity was valued at $21,830,449.

COMMODITY REVIEW

METALS

Copper, Cobalt, Zinc, and Associated Metals (Shaba Region).— Gécamines increased its production of cobalt, copper, zinc, and byproduct silver during 1980, and reported a generally good year, although metal prices declined on the international market, diminishing Gécamines' and Zaire's foreign exchange earnings. Commissioning of the Dikuluwe and Mashamba open pits was completed, including the installation of primary crushers at both pits and conveyors to the new Dima concentrator at Kamoto. The Dima oxide mill was started up on March 1, 1980, at 50% capacity and was later completed to full capacity, as was the Dima sulfide mill. The flash-smelter, and other units of the Luilu refinery, near Kolwezi, were still incomplete, but were scheduled to be onstream by mid-1982 when the Inga-Shaba powerline was due to

be energized. During the first 9 months after the May 1978 invasion of Kolwezi, Gécamines was able to recruit only 100 expatriate employees, most of them unwilling to bring their families to Zaire. Since then, another 100 recruits have arrived, some accompanied by wives and children. By the end of 1980, at least 200 posts remained unfilled, and supervision of on-the-job training of Zairian staff was far behind schedule.

Sodimiza improved its mine and mill production by approximately 14% over the 1979 throughput, and improved its recovery of copper slightly. Its staff was reduced from 3,071 to 3,019 African and from 94 to 86 Japanese employees during 1980, but was increased by yearend because of expansion of the Kinsenda Mine. Increased production of the higher-grade Kinsenda ore was expected to improve the copper content of Sodimiza's concentrate. During 1980, the Kinsenda and Musoshi Mines produced a total of 1,305,256 tons of ore from which the Musoshi mill produced 93,286 tons of concentrate, with an average copper content of 36.78%. The concentrate was railed through Zambia, Zimbabwe (formerly Rhodesia), Botswana, and the Republic of South Africa to the port of East London for shipment to Japan.

Following reorganization of the Société Minière de Tenke-Fungurume (SMTF) in mid-1979, the new French managers, Bureau de Recherches Géologiques et Minières (BRGM), conducted viability-feasibility studies to determine if the company might recoup part of its investment by mining some of the more accessible ore, and upgrading it to a marketable product through Gécamines' facilities. BRGM was also planning to exploit high-grade copper mineralization at Dikulushi near Kapulo, northeast of Lake Mweru.

Gold.—The State agency, Office des Mines d'Or de Kilo-Moto, continued as Zaire's chief producer of gold. Other producers included Société Minière et Industrielle de Kivu (SOMINKI) and Gécamines. Kilo-Moto operated a number of mines near the Ugandan and Sudanese borders in the Haute-Zaire Region of northeastern Zaire. Reserves were approximately 90 metric tons, or 2.9 million troy ounces of gold. Kilo-Moto planned to increase its output from about 50,000 to 160,000 troy ounces per year by 1985. A new processing facility was planned to replace the decrepit Kanga plant, and a new deposit with reserves of 1.3 million troy ounces was to be developed for the Kilo Division. For the Moto Division, laboratory staff were testing ores from a new sulfide ore body. Kilo-Moto was seeking help from the Homestake Mining Co. in adapting the Durba facility for Homestake's activated carbon technology. The Zairian Ministry of Mines was also seeking outside investors to rejuvenate Kilo-Moto.

Manganese.—The Zairian-owned company, Société Minière de Kisenge (SMK), has successfully shipped 11,000 tons of manganese ore on the Benguela Railroad to Lobito Bay since April 1979. It has also managed to achieve a stockpile of 500,000 tons of crushed carbonate ore, and 700,000 tons of uncrushed ore at Kisenge. Reportedly, South African Manganese Amcor Ltd. has indicated an interest in buying 100,000 tons of ore per year, and in mid-1980 was shipped 246 tons of ore for analysis and bulk testing. SMK also planned a dry cell battery factory, including a refinery to convert the mangnese carbonate into electrolyte manganese oxide for battery manufacture.

Tin, Tungsten, and Columbium-Tantalum.—The Société Zairetain continued its tin-tantalum operations at Manono in northeastern Shaba Region, 400 kilometers north of Lubumbashi. The 50% State-owned company, managed and 50% owned by the private Belgian company, Geomines Cie., washed tin oxide (cassiterite) ore from five open pit mines through its concentrator and separated out byproduct columbite-tantalite. The cassiterite concentrate was smelted in Zaire's only tin foundry to produce refined tin metal and a marketable tantaliferous slag or scoria. Most of the near-surface weathered ores have been exhausted, and the remaining unweathered rock was too hard for efficient handling by Zairetain's old earthmoving equipment. The company was seeking additional capital for equipment more suited to the harder ore, and capable of extracting the lithium mineral, spodumene, as well as cassiterite. A 5,000-ton-per-year lithium carbonate plant was proposed.

The BRGM subsidiary, Compagnie Française de Mines, was studying the feasibility of extracting about 500 tons per year of cassiterite from the Kania and Kabondo prospects in the northern Shaba Region. Another subsidiary, Société Minière de Goma, anticipated producing 100 tons of cassiterite per year from the Kalimbi eluvial deposit in the Kivu Region.

Tin ore (cassiterite) was also mined by SOMINKI; other products included tungsten, columbium-tantalum, gold, and monazite. Owned 28% by the GOZ and 72% by Cogemin of the Belgo-French Empain Group, the company was an amalgamation of the many smaller operations in the Kivu Region, with the largest mine and headquarters at Kalima. Other mines were clustered nearby, and still others were grouped near Buni in the north and Kamituga to the east. Transport difficulties aggravated by shortages of diesel fuel and spare parts caused a gradual decline in production.

An affiliated company, SOMIKUBI, was 90% owned by the New York-based Metallurgy Mining Group and 10% by the Group Empain. On their behalf, SOMINKI was investigating the Lueshe carbonatite and its potential as a source of the columbium mineral, pyrochlore. They have completed 3,000 meters of underground development workings in the deposit and have planned construction of a 1.5- to 2-ton-per-hour pilot mill at a cost of $2 million for metallurgical testing as part of a feasibility study. If the results are favorable, full-scale production might start in 1984.

NONMETALS

Cement.— Cimenteries du Shaba was 40% owned by Gécamines and 60% by the Belgian firm, Société d'Etudes et de Gestion de Cimenteries (EGECIM). Renovation by the Belgo-German firm, Ateliers Louis Carton Tournai, was expected to increase production capacity by 40% by the end of 1980 at its Lubumbashi plant. Gécamines' other subsidiary, Calcaire, Chaux, Ciments of Kakontwe, northwest of Lubumbashi, recovered from the effects of breakdowns in 1979 and, with a third rotary oven commencing in January 1980, supplied all the lime required by Gécamines' copper and cobalt refining plants, plus a surplus which was sold on the open market.

Zaire's largest cement plant, owned 51% by EGECIM, and 15% by the GOZ, was the Société des Ciments du Zaire plant at Lukala, near Kinshasa. Shortages of fuel oil and of paper sacks caused declining production in 1980. The second largest manufacturer was the Cimenterie Nationale (CINAT) of Kimpese, also near Kinshasa. The GOZ owned 25% of CINAT, and the 75% equity was owned by West German (Klockner), Belgian, and French interests.

Diamond.—Société Minière de Bakwanga (MIBA), under the management and 20% ownership of the Société Géneral de Belgique and the Oppenheimer group, was still searching for new alluvial deposits of diamonds, but gradually shifting to processing kimberlite ores, of which they have substantial reserves. The company planned to modify and expand its concentrator to handle the harder material and was negotiating with IBRD to finance the renovation which was to be completed by 1983 or 1984. MIBA officials again calculated that about 5 million carats of industrial diamonds were smuggled out of its concession area in 1980, and most were marketed at Bujumbura in Burundi, and at Brazzaville in the Republic of the Congo. Alluvial diggings near Tshikapa and towards the Angolan border continued to be the source for additional diamonds sold by small "diggers" to buying offices maintained by BRITMOND and MELTAX in Tshikapa, Ilebo, and elsewhere in the area. Until early in 1980, the GOZ allowed the diamonds to be bought at a special exchange rate that removed the incentives for smuggling, but this was phased out and the buyers now have to pay for the diamonds in hard currency (dollars). Production from the Bakwenga deposits consists of 70% ordinary industrial stones, 27% high-grade industrial stones, and 3% gems. The Tshikapa deposits include as much as 50% gem-quality stones.

MINERAL FUELS

Petroleum.—Production from Gulf Oil's offshore wells during the early part of 1980 was slightly above 19,000 barrels per day, but on May 27, the Cometra Oil Company's two wells at Mibale-Est and Kinkasi commenced production and were expected to contribute at least 2,000 barrels per day during the latter part of the year.

On June 1, 1980, the Zairian papers reported that Esso-Zaire, an affiliate of American Exxon Oil Co., had signed an agreement with the Executive Council for oil exploration and drilling in Zaire's Central Basin. The joint undertaking with Texaco will include construction of roads and an airstrip in the equatorial jungle and approximately 18 months of preliminary drilling.

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[1]Physical scientist, Branch of Foreign Data.

The Mineral Industry of Zambia

By Miller W. Ellis[1]

The mineral industry of the Republic of Zambia provided more than 90% of the country's foreign exchange credit and supported its position as the world's fifth largest producer of copper and the second largest in mine output of cobalt during 1980. Despite the reopening of the southern railroad routes following the elections in newly independent Zimbabwe in February-March 1980, transport charges continued to be an expensive part of the cost of delivering copper and cobalt metal to the world markets. After being closed for nearly 7 years, the Victoria Falls rail and road bridge over the Zambezi River was reopened to all traffic on February 2, 1980, and the road bridge at Chirundu, downstream from Kariba, was opened for maize-hauling trucks and road traffic on February 11. Road traffic to Botswana was also resumed early in February when the pontoon ferry at Kazungula was repaired and restored to service.

The railroad bridge over the Chambeshi River in northeastern Zambia—destroyed by a military raid in late 1979—was repaired at an estimated cost of $6.5 million by Chinese engineers and hundreds of Tanzania-Zambia Railway (Tazara) workers between August 1980 and the rainy season flooding at yearend. Tazara engineers, who had initially deviated the railway line to cross the nearby road bridge, restored a large measure of rail traffic to the Tanzanian port of Dar es Salaam before the end of February 1980.

The 16th session of the conference of Ministers of Conseil Intergouvernemental des Pays Exportateurs de Cuivre (CIPEC) was held in Lusaka, Zambia, on July 21 to 23, 1980. Full member countries were Chile, Indonesia, Peru, Zaire, and Zambia, but the associate member countries of Australia, Papua New Guinea, and Yugoslavia were also represented. Delegates-observers from Canada, China, Finland, Japan, Mexico, Romania, Sweden, Uganda, the United Kingdom, the United States, and Zimbabwe also attended. The conference noted that marketing of cathode copper was replacing the wirebar demand and that payment of premiums for higher quality products was now a feature of the world market. It passed various resolutions in favor of the marketing and price stabilization policies of the organization, and others for improving technological training at all levels of the industry. It expressed disapproval of the new U.S. law authorizing exploration of seabed minerals beyond the limits of national jurisdiction and agreed to present declarations of its stand on this subject to the Secretary General of the United Nations and to the Chairman of the Third United Nations Conference on the Law of the Sea.

Also in July, the Government of the Republic of Zambia agreed to contract for the sale of copper metal to the German Democratic Republic against the utilization of a commercial credit of about $51 million signed last year between the two countries for rural development and agricultural production. On August 23, 1980, officials from Romania and Zambia signed a joint investment agreement to reopen the Mokambo copper mine, closed by flooding in 1976. Zambia was to supply $2.4 million of the $3.8 million required to capitalize the project, and Romania agreed to provide the remaining $1.4 million and supply technical staff to reopen and operate the mine. A final agreement, signed on November 11, 1980, included a pact for the exploration and exploitation of coal, nickel, phos-

phate, and uranium deposits in Zambia and provided for agricultural assistance. Romanian experts were to expedite the raising of cotton, maize, and sunflower oilseed on 20,000 hectares of land and would barter tractors, fertilizers, and other commodities, thus widening the scope of technical cooperation in trade and economy between the two countries. No mining operations had been started at Mokambo by yearend 1980 because of the uncertain availability of finances.

In May 1980, Zambia drew its final allotment from the $400 million International Monetary Fund (IMF) loan negotiated in 1978. This resulted in a shortening of the country's pipeline of payments arrears to about 13 months. Total arrears were reduced to $355 million by mid-May, at least $86 million below the level for yearend 1979. In December 1980, the World Bank approved a loan of $15 million to the Development Bank of Zambia that was scheduled to result in the creation of some 1,800 new jobs and total investments of more than $48 million. The loan was for 20 years including a grace period of 5 years, with interest at 9.25% per year. The last World Bank loan to this institution was for $15 million in 1976. Officials of the IMF continued to study Zambia's complex financial situation and restricted the issue of letters of credit during the latter months of the year. They were expected to provide the country with a large credit facility and an arrangement for debt servicing early in 1981.

PRODUCTION AND TRADE

Zambia's production of copper increased by about 5% during 1980 and cobalt production rose by nearly as much. An increase of 8% in refined copper output reflected greater use of excess Roan Consolidated Mines Ltd. (RCM) refining capacity by Nchanga Consolidated Copper Mines Ltd. (NCCM). RCM's Ndola plant for treatment of tankhouse slimes was largely responsible for the increase of 30% in gold and 14% in selenium byproduct recovery. The 16% drop in silver output was due in part to diminished production from NCCM's Broken Hill Mine at Kabwe, to the exhaustion of high-grade sulfide ore at RCM's Kalengwa Mine, and to the shutdown of the Kalengwa open pit. Table 1 shows details of Zambia's mineral production.

One of the factors maintaining the price of copper was the U.S. strike of copper-producing workers on July 1, 1980. Settlement of the strike started with Kennecott Copper Corp. on September 9 and continued until The Anaconda Company and ASARCO Incorporated settlements on November 12, 1980. Despite the fact that the strike cost U.S. producers an estimated 400,000 short tons of copper, its effect on copper price was not sufficient to lift copper from the 90-cent-per-pound price on the U.S. market.

The dollar values of Zambia's 1976-79 trade and currency are shown in the following tabulation:

	1976	1977	1978	1979
Total exports (A)	$1050.3	$893.8	$818.4	$1412.0
Copper exports (B)	965.3	818.7	760.3	1167.8
Total imports (C)	791.9	797.9	718.8	904.3
A-C balance	+258.4	+95.9	+99.6	+507.7
Value of 1 kwacha	1.4019	1.2675	1.2307	1.2621

Source: International Financial Statistics. V. 34, No. 6, June 1981, p. 430.

The balances do not indicate an accumulation of foreign exchange because of repayments, servicing of loans, and other disbursements.

On July 26, 1980, the Zambian President announced the banning of essential imports from Europe and the United States in favor of those from apparently cheaper sources in Zimbabwe and South Africa. Some effects of this order on trade routes, as well as railway availability, are shown in table 2. Table 3 shows exports of copper by type and destination. The latest available data about Zambia's exports and imports were tabulated in the chapter for 1978-79.

Table 1.—Zambia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979	1980[p]
METALS					
Cadmium metal	7	4	--	--	1
Cobalt:					
Mine output, metal content of concentrate	3,262	3,677	3,741	4,280	4,400
Metal	2,175	1,704	2,063	3,176	3,310
Copper:					
Mine output:					
Total content of ore	849,642	819,176	766,561	723,978	760,200
Recoverable content of concentrate	708,867	656,000	642,972	588,334	595,757
Metal:					
Blister and anodes, Cu content[2]	[r]711,186	[r]658,487	653,856	582,082	609,935
Refined	694,157	648,043	627,744	561,940	607,592
Gold[3] troy ounces	10,955	[e]11,250	8,457	7,933	10,576
Iron ore: Magnetite	[e]100	[e]100	41	50	378
Lead:					
Mine output, metal content of ore	15,549	13,542	15,853	17,640	[e]13,900
Metal, smelter and refined[4]	13,583	13,109	12,878	12,758	10,047
Selenium, elemental kilograms	--	15,974	30,881	19,980	22,704
Silver[5] thousand troy ounces	1,065	[e]1,450	1,069	914	764
Tin concentrate, gross weight	([6])	3	([6])	1	([6])
Zinc:					
Mine output, metal content of ore	48,777	45,018	50,000	46,600	[e]35,500
Metal, smelter plus electrolytic	36,327	40,114	42,462	38,213	32,686
NONMETALS					
Cement, hydraulic thousand tons	385	[e]400	123	200	160
Clays, building, not further specified do	NA	NA	NA	[7]72	8,392
Feldspar	1,027	832	334	500	475
Fluorspar	3	[e]10	76	--	--
Gem stones:					
Amethyst kilograms	25,878	10,252	9,487	4,860	3,360
Emerald do	18	91	429	[e]400	--
Gypsum	4,650	4,634	1,726	138	--
Lime, hydraulic, and quicklime thousand tons	144	[e]250	[e]250	250	182
Nitrogen: N content of ammonia	[e]20,000	[e]20,000	[e]20,000	[e]20,000	19,600
Pyrite, gross weight	20,643	20,501	2,515	3,002	300
Sand, construction	NA	NA	NA	[8]194,955	[8]196,797
Stone:					
Limestone thousand tons	565	[e]600	227	416	545
Phyllite do	6	13	10	7	8
Miscellaneous, for building	NA	NA	NA	[8]216,136	[8]335,147
Sulfur, elemental basis (produced as sulfuric acid):					
From pyrite	8,773	8,385	991	1,234	123
From copper ores	[e]89,236	[e]86,915	108,784	73,903	92,232
From lead-zinc ores	1,991	--	--	--	--
Total	[e]100,000	[e]95,300	109,775	75,137	92,355
Talc	106	[e]100	[e]100	--	258
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	773	708	1,169	599	569
Petroleum refinery products:[e]					
Gasoline thousand 42-gallon barrels	1,530	1,597	1,658	1,700	NA
Jet fuel do	320	294	360	400	NA
Kerosine do	155	167	200	220	NA
Distillate fuel oil do	2,611	2,551	2,686	2,830	NA
Residual fuel oil do	1,332	1,233	1,399	1,400	NA
Other do	134	110	152	110	NA
Refinery fuel and losses do	374	383	194	128	NA
Total do	6,456	6,335	6,649	6,788	6,800

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 3, 1981.

[2]Includes leach cathodes.

[3]Primarily contained in blister copper and refinery muds.

[4]For all practical purposes, Zambian output of crude lead and refined lead are regarded as equal; the latter is reported, and inasmuch as no impure lead is marketable, no attempt had been made to estimate the trivial difference between the two stages of processing.

[5]Refined silver and silver contained in blister copper and refinery muds.

[6]Less than 1/2 unit.

[7]Converted from figure reported in cubic meters; believed to represent only a small part of total output.

[8]Figure for 1979 reported as cubic meters, while that for 1980 reported as metric tons; it is believed that both figures actually represent metric tons.

Table 2.—Zambia: Exports and imports by trade routes, 1980

(Metric tons)

Route	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total, 1980
EXPORTS					
Exports to Zaire	7,661	17,301	13,882	7,067	45,911
Dar es Salaam (road)	45,310	55,862	48,337	46,807	196,316
Dar es Salaam (rail)	24,702	88,697	85,052	64,419	262,870
Malawi-Mozambique	2,281	1,890	155	100	4,426
Zimbabwe-South (road)	--	--	1,183	4,867	6,050
Zimbabwe-South (rail)	127,516	51,996	41,028	46,298	266,838
Air freight[1]	1,235	693	797	772	3,497
Total Zambian exports	208,705	216,439	190,434	170,330	785,908
Zaire's exports in transit[2 3]	83,507	90,588	82,280	101,932	358,307
Total export traffic	292,212	307,027	272,714	272,262	1,144,215
IMPORTS					
Imports from Zaire	110	395	21	--	526
Dar es Salaam (road)	42,436	44,454	42,031	40,206	169,127
Dar es Salaam (rail)	56,395	58,014	69,371	59,940	243,720
Malawi-Mozambique	1,480	777	685	312	3,254
Zimbabwe-South (road)	12,549	27,649	25,011	8,046	73,255
Zimbabwe-South (rail)	88,622	92,572	121,403	68,258	370,855
Air freight	5,818	4,939	4,690	4,199	19,646
Total Zambian imports	207,410	228,800	263,212	180,961	[4]880,383
Zaire's imports in transit[3]	98,537	109,505	94,563	102,030	404,635
Total import traffic	305,947	338,305	357,775	282,991	[4]1,285,018

[1]Includes cobalt metal.
[2]Includes an average of 9,480 tons per month of concentrates to port of East London for shipment to Japan.
[3]Does not include any significant amount of traffic with Dar es Salaam.
[4]Does not include 744,289 tons of crude oil imported by Tazama pipeline.

Table 3.—Zambia: Exports of copper, by type and destination

(Metric tons)

Type of copper and country of destination	1977	1978	1979
Blister:			
Germany, Federal Republic of	78	--	--
Japan	--	4,108	1,189
Korea, Republic of	--	--	6,834
Poland	2,000	--	--
Portugal	--	500	--
Spain	501	998	1,702
United States	--	7,571	425
Yugoslavia	5,549	12,427	10,761
Total	8,128	25,604	20,911
Refined:			
Austria	1,850	2,738	450
Belgium	21,122	10,077	19,082
Brazil	--	--	11,618
Canada	--	--	1,999
China, mainland	23,493	17,503	20,626
Denmark	676	301	407
Egypt	3,146	4,325	3,797
Finland	1,501	566	3,454
France	66,432	61,234	86,041
Germany, Federal Republic of	90,777	50,734	72,980
Greece	5,029	4,386	4,296
India	13,425	34,895	41,576
Indonesia	--	--	3,994
Italy	72,920	51,672	56,687
Japan	128,231	133,292	148,788
Korea, Republic of	--	--	8,899
Netherlands	1,277	679	1,833
Romania	--	3,999	2,002
Spain	--	--	1,998
Sweden	19,556	18,706	16,153
Switzerland	9,167	2,589	6,977

See footnotes at end of table.

Table 3.—Zambia: Exports of copper, by type and destination —Continued

(Metric tons)

Type of copper and country of destination	1977	1978	1979
Refined —Continued			
Taiwan	6,097	--	--
Thailand	--	--	2,852
United Kingdom	101,621	79,699	71,329
United States	76,475	53,771	23,453
Yugoslavia	4,000	17,852	10,835
Others	291	869	3,655
Total	647,086	549,887	625,781

Source: World Bureau of Metal Statistics. World Metal Statistics. London, September 1980, p. 72.

In March 1980, it was widely reported that Zambia had negotiated a trade of cobalt to the U.S.S.R. for about $85 million worth of military aircraft (MiG-21) and other weaponry. This represented less than 1,542 tons of cobalt, or about half the country's annual production of that metal, and could have been transported readily as cargo on the scheduled Lusaka-Moscow airline flights during the remainder of the year.

COMMODITY REVIEW

METALS

Copper, Cobalt, Byproduct Gold, Selenium, and Silver.— Zambia's two major mining companies treated about 32 million tons of ore containing more than 750,000 tons of copper. Estimates of ore milled by RCM during 1980 and the RCM ore reserve figures as published in the RCM annual report for the yearend March 31, 1980, are shown in table 4. RCM noted that 1980 was the 10th anniversary of its existence following the acquisition by Zambia of a 51% interest in the operating subsidiaries of Roan Selection Trust Ltd. on January 1, 1970. During the decade, expansion of production was achieved by the acquisition and development of the Baluba Mine and the expansion of Chambishi. Minor expansion programs included deepening and equipping the service shaft at Mufulira to allow stoping below the existing facilities by 1986.

Table 4.—Zambia: RCM copper production and ore reserves

Mine	Ore mined and treated			Ore reserves		
	Gross weight (thousand metric tons)	Copper (percent)	Copper content (metric tons)	Gross weight (thousand metric tons)	Copper (percent)	Cobalt (percent)
Mufulira UG	6,181	2.12	131,037	115,000	3.09	--
Luanshya UG	4,358	1.32	57,526	57,000	2.48	--
Baluba UG	1,855	1.90	35,245	62,000	2.58	0.15
Chambishi UG	2,229	1.74	38,785	34,000	2.85	--
Chibuluma UG	558	2.93	16,349	7,600	4.03	.20
Kalengwa OP[1]	204	2.35	4,794	--	--	--
Total or average	15,385	1.84	283,736	275,600	2.85	.042

OP Open pit. UG Underground.

[1]Stockpiled ore was used for Kalengwa mill feed.

The Chibuluma West main hoisting shaft was completed early in 1980 and new ore and waste rock passes were raise-bored to a 1.8-meter diameter for a distance of 365 meters. A connection between the new shaft and the 385-meter level of the 5A subinclined shaft was to be the main extraction level for Chibuluma West ore. The Chambishi shaft and underground workings were completely readied for maximum ore extraction down to the 500-meter level, and planning and feasibility studies for extracting the ore below the 500-meter level were started. Construction of additional copper tankhouse and cobalt refining facilities at Chambishi was started in the latter half of 1980. At Baluba, deepening of the rock hoisting shaft was completed, and lateral development was proceeding from some of the completed station installations while other stations were being installed. Extensions to the concentrator and expansion of the engineering services continued, and housing and transportation were provided for the additional labor needed to maximize output. The recovery of gold and selenium at RCM's Ndola refinery set records for this recently constructed plant.

NCCM's estimated ore production of 17.1 million tons included some 5 million tons of Rokana ore containing 87,000 tons of copper and 5,490 tons of cobalt. Table 5 lists the estimated tonnage of ore treated and held in ore reserves at NCCM's mines for 1980. Delays in the delivery of spares and lack of skilled and experienced maintenance staff have caused a general and gradual deterioration of plant and equipment throughout Zambia's Copperbelt. Reduced production rates were also the result of reduced expenditure because of lowering copper prices in the latter part of the year. Cobalt prices remained unchanged at $25 per pound.

Table 5.—Zambia: NCCM copper production and ore reserves

Mine	Ore mined and treated			Ore reserves		
	Gross weight (thousand metric tons)	Copper (percent)	Copper content (metric tons)	Gross weight (thousand metric tons)	Copper (percent)	Cobalt (percent)
Nkana UG	4,996	1.75	87,430	117,988	2.35	0.11
Bwana Mkubwa OP	817	3.04	24,837	723	3.61	--
Chingola UG-OP	9,185	3.23	296,676	281,431	3.14	--
Konkola UG	1,875	2.88	54,000	185,845	3.68	--
Kansanshi OP	237	2.97	7,039	16,980	2.58	--
Total or average	17,110	2.75	469,982	602,967	3.14	.022

OP Open pit. UG Underground.

At the Chingola Division, the shortage of spares for open pit vehicles caused a continuing shortfall of overburden stripping at the Nchanga open pit. The rehabilitation of the Chingola West Mill was completed and resulted in improved performance. Production from the tailings leach plant remained high despite the constraints caused by intermittant shortages of acid. Drilling indicated that cobaltiferous ore in the lower orebody of the Nchanga underground mine was richer in both copper and cobalt than previously estimated.

At the Rokana Division, good ore grades continued from both South Orebody and Central Shaft production. Big hole blasting techniques were extended in the Mindola section stopes and the technique was introduced in suitable areas at the South Orebody. At the concentrator, the first bank of 12 new 300-cubic-foot flotation cells was completed. Rehabilitation and enlargement of the cobalt plant and the copper tankhouse were started, as was construction of the new roast-leach-electrowin cobalt plant. Water extraction at the Konkola Division continued at an average rate of 399,478 cubic meters per day or 79 tons of water per ton of ore. NCCM's Bwana Mkubwa Mine near Ndola was declared likely to close by 1982 although a small production was scheduled if a feasible process was found for treating tailings and old dumps. Bwana Mkubwa was one of Zambia's scenes of prehistoric copper mining when it was discovered in 1902. Its high-grade malachite ores were found the following year, but commercial exploitation awaited the arrival of the railway extension north from Broken Hill, and production was started in 1913. Production was halted several times before an open pit operation commenced in 1926.

The mine was soon closed because of unprofitability and sold to Rhokana Corp. Ltd. in 1931. The Rokana Division of NCCM operated the mine in the 1970's.

The NCCM plan for increased cobalt production was reportedly designed to triple Zambia's output of that metal to 10,000 tons per year by a two-stage development program. A new cobalt refinery was to be established at Kitwe to produce 5,700 tons of cobalt metal per year on completion of the second phase of the project in 1985. The first stage was due to come onstream in 1982 with 2,600 tons per year capacity. A small-scale project to recover 700 tons per year initially from Rokana copper smelter slag was designed and would presumably be enlarged for the additional 2,400 tons capacity envisaged for stage 2. Production at NCCM's Nampundwe pyrite mine west of Lusaka was curtailed by the deepening of No. 1 shaft to ensure future ore production at the rate of more than 1,000 tons of ore per day to provide concentrates for the planned new acid plants.

Lead, Zinc, and Byproduct Cadmium.—Ore and concentrate production dropped during the year, finished lead metal declined 21%, and finished zinc metal was 14% lower than in 1979. Excessive plant downtime for repairs and the exhaustion of coke stocks were major reasons for reduced output. Byproduct cadmium output totaled 1.385 tons. Exploration by diamond drilling at NCCM's Broken Hill Mine revealed an additional 300,000 tons of lead and zinc ore that was to be reached by sinking the present subvertical shaft to a depth of 1,650 feet at a cost of $4 million. These reserves were estimated to extend the life of the mine by about 5 years. The managing director of the Metal Marketing Corp. of Zambia, Ltd. (MEMACO), reported that exports of lead and zinc to Zimbabwe customers were resumed after April 1980 and were expected to reach a rate of about 2,000 tons of each metal per year by the end of the year.

NONMETALS

Cement.—Cement Ltd. of Dublin, Ireland, has agreed to provide management and training of technical skills for local personnel both in Zambia and in Ireland. Chilanga Cement Ltd., south of Lusaka, continued to operate its coal-fired plant.

Fertilizer Materials.—In mid-1980, it was announced that Mitsubishi of Japan had won a contract and was to build a 100,000-ton-per-year sulfuric acid plant at the Kafue fertilizer factory. The plant was scheduled to have a turnkey cost of $40 million and to be onstream by 1983. This was an addition to the $400 million plus fertilizer complex of Nitrogen Chemicals of Zambia (NCZ), the commissioning of which was started by Klockner-Werke AG in November 1980. The complex included a 60,000-ton-per-year ammonia plant and facilities to upgrade Zambia's fertilizer capacity from 50,000 to 200,000 tons per year. Klockner agreed to back up NCZ's technical staff during commissioning and a trial run, which was expected to take from 8 to 10 months.

Gem Stones (Amethyst and Emerald).—Production of amethyst declined 31% in 1980, but preparation of rough amethyst cutting material for export continued as did fabrication into cut and polished stones and jewelry. A new company, Gem Industries Ltd., reportedly was successfully marketing Zambian gems at shops in Ndola and at the duty-free Lusaka International Airport, as well as on Zambia Airways international flights since August 1980. Production of Zambian emeralds was not specifically reported in 1980.

MINERAL FUELS

Production of bituminous coal from Maamba colliery declined to 569,000 tons of washed material. The Government of Austria agreed to grant Zambia $1.3 million to construct a coal reclamation plant and storage facilities at Maamba and also arranged to convert an earlier loan of the same amount to a grant.

A new company, Lublend, composed of Mobile Petroleum Co. Inc. (40%), the Zambia Industrial and Mining Corp. (ZIMCO) (35%), and Zambian National Energy Ltd. (ZNEL) (25%) was to construct a new $7.6 million plant at Bwana Mkubwa, south of Ndola. The plant was to produce some 100,000 barrels of lubricating oils and greases per year, and construction was to be completed about June of 1982.

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[1]Physical scientist, Branch of Foreign Data.

The Mineral Industry of Zimbabwe

By George A. Morgan[1]

In March 1980, national elections were held and a new Government came into power, achieving internationally recognized independent nation status with the name Zimbabwe (formerly Southern Rhodesia). A prior cease-fire among hostile factions in a 7-year war led to the termination of trade sanctions. Trade sanctions had been imposed against the country by the United Kingdom, the United States, and other countries following the Unilateral Declaration of Independence (UDI) in November 1965. In April 1980 the U.S. Liaison Office in Salisbury was elevated to Embassy status and the country became the beneficiary of the U.S. General System of Preferences (GSP) trade benefits. Provisions of the GSP allowed for duty-free status for a number of mineral commodities. The Government has indicated that foreign investment in new plants and mining ventures can be repatriated after 2 years, and 50% of aftertax profit can be sent abroad. It had also encouraged joint ventures and has reserved the option to participate in major investment projects. A 10% surcharge on income tax was instituted in early 1980 to help balance the budget, and all foreign exchange transactions had to be approved by the Reserve Bank of Zimbabwe.

The mining industry prospered substantially during the past 15 years, with fundraising for capital investment and the maintenance of equipment carried on internally. Only in the field of exploration was there significant reduction of activity because of the withdrawal of survey teams from insecure areas. The Mines and Minerals Act of 1961 continued to be the legitimate mining law in Zimbabwe, and it was administered through the Ministry of Mines and Energy Resources. The country was divided into four mining districts, each governed by a district mining commissioner who reported directly to the Minister of Mines. The management and safety of all operating or abandoned mines in Zimbabwe was governed by the Mining (Management and Safety) Regulation of 1974. A depletion allowance of 5% was allowed on all minerals. About 61,000 people, or 6% of all wage earners in Zimbabwe, excluding peasant agriculture, were employed in the mining and quarrying industry.

PRODUCTION AND TRADE

Mineral production was valued at $614 million[2] in 1980 compared with $466 million in 1979. However, the index of volume of crude mineral output declined for the fourth consecutive year from a high of 206 (1964=100) in 1976 to 182 in 1980. The mining and quarrying sector of the economy accounted for about 7% of the gross domestic product (GDP), which was estimated at $2,750 million in 1980, up 12% from the previous year. The index of volume of production for manufactured nonmetallic mineral products increased 16.6%, and the index for metals and metal products increased 11%. The manufacturing sector, which included production of metal and nonmetal products, made up about 25% of the GDP.[3]

Zimbabwe's input to the Central African Power Corp. (CAPC), which was the source for the major portion of electric power

Table 1.—Zimbabwe: Produc

(Metric tons unless

Commodity[2]	1965	1966	1967	1968
METALS				
Aluminum: Bauxite, gross weight	1,615	943	490	472
Antimony, mine output, metal content	252	252	512	562
Arsenic, white	46	11	141	370
Beryllium: Beryl concentrate, gross weight	83	77	128	278
Cesium minerals: Pollucite	122	--	38	--
Chromium: Chromite, gross weight thousand tons	586	586	558	433
Cobalt:				
Mine output, recoverable metal content[e]	--	--	--	--
Metal (including content of refinery sludges)	--	--	--	--
Columbium-tantalum minerals, gross weight:				
Columbite	2	1	21	10
Tantalite	39	34	39	27
Copper:				
Mine output, metal content	18,000	16,000	22,200	21,000
Metal:[3]				
Smelter, primary[e]	15,000	15,100	17,600	19,300
Refinery, primary	14,812	15,019	17,573	19,274
Gold, mine output, metal content thousand troy ounces	550	541	493	467
Iron and steel:				
Iron ore:				
Gross weight thousand tons	1,287	869	1,228	1,028
Metal content[e] do	772	521	737	617
Metal:				
Pig iron[e] do	350	350	400	300
Ferroalloys:[e]				
Ferromanganese				
Ferrochromium	30,000	30,000	30,000	30,000
Total	30,000	30,000	30,000	30,000
Crude steel thousand tons	[e]140	[e]140	130	140
Nickel:				
Mine output, metal content	[e]470	[e]500	[e]400	441
Metal, smelter[e 4]	--	--	--	--
Silver, mine output, metal content thousand troy ounces	83	87	113	202
Tin:				
Mine output, metal content[e]	710	960	1,210	1,290
Metal, smelter	511	689	875	928
Tungsten, concentrate output:				
Gross weight	29	27	190	210
Metal content[e]	14	13	90	100
NONMETALS				
Abrasives: Natural corundum	4,045	7,830	7,678	8,364
Asbestos thousand tons	160	163	154	168
Barite	1,532	1,903	963	946
Cement, hydraulic thousand tons	[e]187	[e]200	[e]300	339
Clays:				
Bentonite (montmorillonite)	NA	NA	24,598	74,635
Fire clay	17,991	14,678	13,857	12,231
Kaolin	--	--	--	264
Feldspar	176	816	542	933
Fluorspar	178	797	1,437	746
Gem stones, precious and semiprecious:[5]				
Amethyst kilograms	752	964	116	13,014
Garnet do	2,111	3,766	1,365	1,686
Topaz do	33	4	7	14
Tourmaline do	9	11	10	49
Graphite	--	425	3,110	2,750
Kyanite	1,085	5,599	1,852	1,327
Lithium minerals, gross weight	53,865	36,383	48,946	34,032
Magnesite	35,608	80,907	88,864	96,154
Mica	1,889	2,893	1,827	4,560
Nitrogen: N content of ammonia[e] thousand tons	20	20	20	20
Phosphate rock, marketable concentrate do	19	68	75	91
Pyrite, gross weight do	78	73	71	80
Quartz[6]	39,016	10,221	9,263	22,010
Stone: Limestone thousand tons	606	593	694	795
Sulfur:				
S content of pyrite do	33	31	30	34
Byproduct of coal and metallurgy[e] do	2	2	2	2
Total[e] do	35	33	32	36
Talc	433	691	1,094	1,735

See footnotes at end of table.

tion of mineral commodities[1]

otherwise specified)

1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980[p]
399	e350	e350	e300	337	94	156	r3,099	r3,276	4,818	5,076	4,281
141	e140	e300	e380	381	120	400	279	551	121	158	150
279	e250	e100	e--	--	--	--	139	201	129	--	79
280	e250	e100	e100	42	35	291	94	103	35	28	9
--	e--	e--	e50	56	--	81	281	--	--	--	--
371	504	672	755	790	703	876	864	677	478	542	552
NA	NA	NA	43	23	28	18	NA	NA	17	210	120
--	--	--	43	23	28	18	--	--	17	204	115
5	--	--	--	--	--	--	--	--	--	--	--
18	e20	e30	e20	67	18	23	19	30	31	30	41
28,700	30,000	34,400	46,500	51,652	47,481	47,579	r48,186	r34,767	33,848	29,724	26,921
22,300	24,700	27,300	35,000	35,000	35,000	34,800	r30,700	r32,500	r32,200	28,500	26,100
21,148	e23,700	e26,300	e3,000	e3,000	e3,000	e3,000	e3,000	e3,000	e3,000	e3,000	e3,100
446	438	399	349	338	335	354	r388	402	399	388	368
749	813	818	723	735	715	1,246	1,352	1,176	1,123	1,201	1,622
449	488	491	434	441	429	748	811	706	674	721	973
260	280	280	290	290	300	310	310	310	600	600	600
--	--	--	--	--	--	--	--	2,400	2,400	2,400	2,400
30,000	100,000	100,000	100,000	100,000	180,000	180,000	185,000	200,000	200,000	200,000	260,000
30,000	100,000	100,000	100,000	100,000	180,000	180,000	185,000	202,400	202,400	202,400	262,400
300	350	439	462	485	491	524	733	734	778	740	804
5,747	8,585	9,278	10,115	10,330	10,694	9,121	r13,616	16,671	15,701	14,591	15,075
5,500	8,000	9,000	10,000	10,000	10,000	9,000	10,000	13,000	13,000	13,200	14,100
167	210	252	271	270	240	242	200	207	1,109	978	954
1,350	1,520	1,550	1,375	1,580	1,510	1,380	1,270	1,280	1,310	1,340	1,300
972	1,094	1,118	990	1,138	1,089	997	915	920	945	967	934
270	e420	e420	317	380	274	229	248	252	279	224	194
128	200	200	170	180	130	110	118	120	130	110	90
8,855	e1,800	e500	--	--	1,302	5,429	r4,849	r4,846	7,366	16,628	18,681
179	188	206	206	262	261	262	281	273	249	260	251
1,523	e1,700	e1,800	e2,000	2,189	2,280	1,272	1,480	2,798	878	449	195
382	474	529	626	673	754	677	540	492	408	396	e400
61,665	e100,000	e200,000	e300,000	372,063	113,477	109,302	81,701	58,529	53,319	54,320	69,153
16,754	e17,000	e17,000	e17,000	17,252	17,339	17,559	14,448	13,113	12,430	16,745	17,005
261	e1,000	e2,000	e3,000	3,678	4,542	2,628	4,346	4,543	1,017	2,686	4,450
1,024	e1,200	e1,300	e1,400	1,470	2,206	1,499	3,029	896	726	1,085	1,263
340	300	e350	e350	474	919	585	690	522	312	--	--
6,910	NA	NA	NA	2,073	3,164	3,566	4,524	6,828	3,491	3,228	4,001
1,774	NA	NA	NA	2,454	4,132	--	18,900	--	133	2,000	125
3	NA	NA	NA	38	150	310	--	8	2	--	--
188	NA	NA	NA	82	--	2	--	523	98	6	5
4,614	e4,000	e3,000	e3,000	e3,000	e3,000	e3,000	e3,000	e3,000	e5,000	5,736	e5,800
489	e400	e1,000	e3,000	4,637	6,807	8,045	9,520	6,339	1,835	--	716
35,599	e25,000	e10,000	e10,000	12,989	37,865	883	40,722	8,050	16,688	13,197	21,030
84,830	e85,000	e85,000	e85,000	87,194	88,803	99,360	95,051	54,204	65,756	84,495	78,217
3,868	e4,000	e4,000	e4,000	5,728	3,010	5,945	1,832	3,670	2,764	1,275	1,022
50	50	50	50	50	50	70	70	70	60	60	60
92	e100	e100	e100	101	148	151	111	105	107	136	130
80	e70	e60	e50	50	76	67	51	53	56	66	68
23,054	e50,000	e100,000	e150,000	175,784	167,813	193,179	178,234	166,208	95,588	143,688	166,407
825	e900	e1,000	e1,200	1,313	1,173	1,368	1,349	1,299	1,087	1,057	1,218
34	e30	e25	e20	21	32	28	21	22	24	28	29
2	2	2	2	2	2	2	5	5	5	5	5
36	32	27	22	23	34	30	r26	r27	r29	33	34
231	e500	e1,000	e1,800	2,060	918	1,500	1,909	1,415	758	1,170	456

Table 1.—Zimbabwe: Production of

(Metric tons unless

Commodity[2]		1965	1966	1967	1968
MINERAL FUEL AND RELATED MATERIALS					
Coal, bituminous	thousand tons	3,509	3,103	3,206	3,203
Coke, metallurgical[7]	do	e100	e200	205	221

eEstimated. pPreliminary. rRevised. NA Not available.

[1]Table includes data available through July 7, 1981, and provides all data available to the U.S. Bureau of Mines on the Zimbabwe).

[2]In addition to the commodities listed, a few others were occasionally reported. These, with quantities in metric tons, 1979—1,632.

[3]Smelter copper includes impure cathodes produced by electrowinning in nickel processing. Output of fire-refined date include only electrolytic copper output by Corsyn Consolidated Mines at the Inyati Mine.

[4]Includes Ni content of nickel oxide and nickel fonte.

[5]Other gem stones were sporadically produced, as follows, in kilograms: Amazonite: 1965—2,532, 1966—2,259, 1967—

[6]Includes rough and ground quartz as well as silica sand. Quartz crystal was also produced in the amount of 3 metric

[7]Data represent output by the Wankie Colliery for years ending Aug. 31 of that stated; additional output by the Radcliff

generation for Zambia and Zimbabwe, increased 7.8%. Total electricity usage by Zimbabwe was up 8.5% to 7.3 billion kilowatt-hours. In addition to coal and hydroelectric power, the first ethanol plant was commissioned in April to supplant imports of gasoline and diesel fuel.

The new Government expressed commitment to the needs of the mining industry, with the Ministry of Mines and Energy Resources responsible for supplying advice and financial assistance. The Gold Mining Act was repassed in September to provide financial assistance to miners in case of declining prices. The Government also indicated interest in furthering its control of the mining industry by supporting a 35%-equity participation in current operations and a 50%-equity participation in new mines. At yearend, the Government proposed the creation of a central marketing agency for all mineral industry products.

Overall costs increased substantially for the mining sector. Mines also suffered from a severe shortage of skilled workers either because of prior military callups or emigration. A minimum wage, passed in late 1980, mandated statuatory wage increases. One company reported that salaries and wages accounted for 55% of total costs, while

mineral commodities[1]—Continued

otherwise specified)

1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980[p]
3,299	3,520	3,360	2,908	3,536	3,105	3,300	3,593	3,029	3,065	3,188	3,188
243	[e]245	[e]245	297	237	267	[e]270	227	194	179	201	235

mineral output of Zimbabwe following the Unilateral Declaration of Independence by Southern Rhodesia (now

were as follows: Bismuth: 1967—1 and 1968—1; diatomite: 1965—355 and 1968—98; and mineral pigments (ocher):

copper by Messina (Transvaal) Development Corp. apparently was terminated in 1972. Refined copper output from that

13,161, and 1969—91; chrysoberyl: 1965—28, 1966—insignificant, 1968—23, and 1969—5; and cordierite: 1965—1.
tons in 1979.
plant of Risco Ltd. may total 250,000 metric tons per year of metallurgical coke and coke breeze.

working costs increased 38% mainly because of adjustments in salaries and wage scales. Taxes increased on gold produced because of a reduction in the depletion allowance to 5% from 15%.[4]

Trade data relating to individual mineral commodities by recipient or source country continued to be unavailable. However, 11 months of data for 1980 indicated that mineral-related products accounted for 56% of the total value of all commodities exported. Among individual mineral commodities, gold made up 71% of the total value of mineral products exported and thus was the principal foreign exchange earner. Exports of iron and steel ingots, rods, and sections amounted to nearly 500,000 tons for the period, while over 245,000 tons of ferroalloys were exported. The major import items by value were energy related, with refined petroleum products accounting for the largest portion.

Prior to closure of rail routes through Mozambique, about two-thirds of Zimbabwe's rail traffic was to the ports of Beira and Maputo. By 1980, nearly 90% of all Zimbabwe's export and import traffic used the Republic of South Africa rail system, with limited use of Mozambique ports.

Table 2.—Zimbabwe: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1978	1979
Asbestos		212,437	285,021
Cement		36,416	41,595
Coal, all grades		216,614	195,952
Cobalt oxides	value, thousands	--	$3,423
Coke and semicoke		110,528	131,629
Copper metal including alloys, all forms		35,856	26,635
Gold metal including alloys, all forms[1]	value, thousands	$68,311	$98,788
Iron and steel metal:			
Ferroalloys		101,548	170,951
Steel, primary forms		324,466	237,891
Semimanufactures:			
Bars, rods, angles, shapes, sections		234,748	225,397
Wire		20,085	17,773
Other	value, thousands	$15,697	$19,164
Lithium ores	do	$1,394	$1,479
Nickel metal including alloys, all forms		16,534	13,891
Precious metals, waste	value, thousands	$1,243	$2,670
Precious and semiprecious stones, worked or unworked	do	$1,100	$1,872
Tantalum ore	do	$55	$2,772
Tin metal including alloys, all forms		748	865
Tungsten ore and concentrate	value, thousands	$2,365	$1,909

[1]Data represent sales.

Table 3.—Zimbabwe: Imports of mineral commodities

(Thousand dollars)

Commodity	1978	1979
Aluminum metal including alloys, semimanufactures	2,682	3,720
Building materials, refractory	5,744	6,954
Fertilizer materials:		
Manufactured:		
Nitrogenous	1,832	1,946
Potassic	5,203	3,889
Ammonia	2,571	2,031
Iron and steel metal:		
Ferroalloys	1,543	2,020
Semimanufactures:		
Bars, rods, angles, shapes, sections	2,761	4,176
Universals, plates, sheets	17,591	31,506
Rails and accessories	1,378	147
Lead metal including alloys, semimanufactures	535	1,285
Petroleum and related products	116,178	218,096
Salt	1,394	1,529

COMMODITY REVIEW

METALS

Chromite.—Production of chromite in Zimbabwe was from both podiform and stratiform deposits. Production from an eluvial chromite deposit ceased in 1956 with the closure of the Feoch Mine, west of Motorshanga Pass. Union Carbide Corp. operated the Selukwe Peak and Railway Block Mines in podiform deposits through Zimbabwe Mining and Smelting Co. Ltd., formerly Rhodesia Chrome Mines Ltd. Output from the two mines accounted for about 70% of the country's total production. Rhodall Ltd., formerly Rhodesia Alloys Ltd., a subsidiary of Anglo-American Corp., operated a number of mines in the Salisbury district. About 30 mines were estimated to be producing chromite in the stratiform deposits of the Great Dyke, with output from mining operations on the Great Dyke accounting for about 25% of the total production. Chromite seams ranged in thickness from several centimeters to 40 centimeters. Mining of productive seams was by resue stoping, with waste rock removed prior to handpicking of ore. Total mine capacity for production of chromite in Zimbabwe was about 1 million tons per year.

Rhodall Ltd. had five ferrochromium furnaces operating at Gwelo, with a total capacity of 70 megawatts or about 113,000 tons per year of high-carbon ferrochromium, low-carbon ferrochromium and ferrosilicon chromium. A new 30-megawatt

furnace, scheduled for completion in 1982, was expected to increase production capacity of high-carbon ferrochromium by 50,000 tons per year. The Zimbabwe Mining and Smelting Co., Ltd., had four furnaces in operation at Que Que, with a total capacity of 50 megawatts or about 90,000 tons per year of ferrochrome. Two new furnaces of 24-megawatt capacity each were under construction and scheduled for completion in 1981 and 1982. They would each add about 45,000 tons per year of ferrochromium capacity to the plant at Que Que.

Cobalt.—Byproduct production of cobalt from nickel was initially solely from the Bindura smelting plant of Bindura Nickel Corp. (BNC), formerly Rhodesian Nickel Corp. (Rhonick). A cobalt recovery plant was added to the nickel smelter at Eiffel Flats in 1979 to process residue from the Empress Mine. About 50 tons of cobalt sludge was produced by BNC from Trojan, Madziwa, and Epoch nickel mine concentrates, and 31 tons of cobalt in sludge was produced from Shangani nickel concentrates in 1979. The remainder was from Rio Tinto (Zimbabwe) Ltd.'s (formerly Rio Tinto Rhodesia Ltd.) Empress Mine. Future output was expected to stabilize below 200 tons per year due to the exhaustion of stockpiled material.

Copper.—Production of copper continued to decline despite a mild recovery in price in early 1980. Approximately 30 mines produced copper either as a primary metal or as a byproduct or coproduct of other metal output. About 3,000 tons of copper was produced as a byproduct of nickel mining, mainly from the Empress and Madziwa Mines. Impure copper cathodes from nickel electrowinning plants were refined outside the country.[5] M.T.D. (Mangula) Ltd. was the leading producer, with output of 14,500 tons in 1980 compared with 16,600 tons in 1979. The principal copper deposits in Zimbabwe, along with reserves and grade, are listed in the following tabulation:

Deposit	Reserves (thousand tons)	Grade (percent copper)
Alaska	579	1.11
Avondale	320	1.14
Copper Queen	15,000	1.40
Inyati	870	1.54
Miriam	14,000	1.27
Norah	3,000	1.35
Shackleton	837	1.26

A number of mines were on a care and maintenance basis, such as the Shamrocke, Alaska, and Gwai River Mines. The Mangula operation, which includes the Miriam and Norah Mines, was the leading copper producer. In the year ending September 30, 1980, ore production was 1.2 million tons grading 0.86% copper at the Miriam Mine and 509,000 tons grading 1.08% at the Norah Mine. Data available on copper milling operations in 1980 are listed in the following tabulation:

Mill	Throughput (thousand tons)	Grade (percent copper)	Copper in concentrates (tons)
Inyati	193	1.54	2,964
Miriam	1,203	.86	9,641
Muriel	63	NA	348
Norah	534	1.07	5,332
Shackleton	466	1.05	e4,800

eEstimated. NA Not available.

Mangula began commissioning its 20,000-ton-per-year refinery in November. Full capacity was expected to be online in April 1981. Financing for the project was from local borrowing, with Zimbabwean labor and materials used for most of the construction. The Lonrho Investments Group's subsidiary, Coronation Syndicate, operated the Inyati and Muriel Mines through Corsyn Consolidated Mines. A smelter and refinery existed at the Inyati Mine for treating a portion of the mines' output for production of 3,100 tons per year of refined copper. Refined copper produced at Inyati was used locally for the manufacture of copper cable, most of which was exported. Lonrho gained full ownership of Nyaschere Copper (Pvt.), in which it already controlled 50%. The company was the operator for the Nyaschere and Shamrocke Mines.

Gold.—About 260 gold mines were operational in 1980, with 22 mines accounting for nearly 78% of the total output.[6] The principal mining concerns were Lonrho, Falcon Mines Ltd., Falconbridge Nickel Corp., Homestake Mines (Pvt.) Ltd., and Rio Tinto Zimbabwe Ltd. Lonrho was the largest gold producer with eight mines, five of which were opened since UDI. Lonrho's subsidiary, Coronation Syndicate, owned Corsyn Consolidated Mines, which operated the Arcturus, Mazoe, Muriel, and Inyati Mines. Another subsidiary, Attica Mines (Pvt.) Ltd., operated the Shamva and How Mines. Independence Mining (Pvt.) Ltd. also a Lonrho affiliate, operated the Old West and Redwing Mines near Umtali. The group's Mashona Kop Mine near Salisbury ceased operation in early 1980 due to depletion of ore reserves.[7] Assets remaining from the operation were transferred to the Arcturus

Mine, which was one of the leading gold producers in Zimbabwe, employing 730 personnel. Production in the year ending September 30, 1980, was 19,000 troy ounces. Crosscut extensions made on number 10 level during what was expected to be the last month of mine life intersected new ore. As of June 30, 1980, proved reserves were 501,000 tons grading 0.28 troy ounce of gold per ton. Modifications of the mill were also under way to allow processing of weathered ore by 1981. In the year ending September 30, 1980, Corsyn Consolidated Mines had a total mill throughput of 462,000 tons, with a production of 56,600 troy ounces of gold, 68,700 troy ounces of silver, and 3,300 tons of copper. The company expected to improve recovery of gold, silver, and copper, with a slight increase in mill throughput. In addition, 14,700 meters of primary development and 700 meters of shaft sinking were planned in the new year.[8]

Falcon Mines Ltd. was the second largest producer of gold in Zimbabwe after Lonrho. The company operated the Arlandzer, Dalny, Mascot, Turkois, and Venice Mines. The company also had a 40% share in Olympus Consolidated Mines Ltd., which operated the Commoner Mine in Gatooma and the Old Nic and Dawn Mines near Bulawayo. Falcon Mines Ltd. placed its recently acquired Golden Oriole Mine into production in May 1980. However, results were below those expected because of metallurgical problems. A new concentrator was being built at the Venice Mine, along with a new shaft to supply the 6,000-ton-per-month capacity of the plant. This production will be in addition to the 5,000 tons per month supplied to the Dalny plant, which also was to be expanded to 7,000 tons per month. The Dalny Mine was the largest gold producer in Zimbabwe, employing over 1,500 personnel. The company reported a total mill throughput of 241,550 tons in 1980, yielding 47,900 troy ounces of gold. Reserves were reported at 2 million tons, averaging 0.29 troy ounce per ton. Working costs increased 38% in 1980, mainly due to salary and wage scale adjustments. Additionally, the taxation charge increased due to reduction of the depletion allowance from 15% to 5%. Capital expenditures of $6.7 million were planned for the new year, mainly for the Venice and Dalny Mines.

Iron and Steel.—Rhodesian Iron and Steel Co. Ltd. (RISCO), the country's sole iron and steel producer, expanded its export markets with increased sales of billets to other African nations having rerolling facilities. With only about 25% of production used locally, RISCO was capable of supplying 100,000 tons per year of billets for export. A $148 million expansion plan was under way to double this capacity. In addition to Kenya, overseas markets included Bangladesh, the Republic of Korea, Saudi Arabia, and several members of the European Communities.[9]

Iron ore feed to the four blast furnaces at the steel plant was from the Ripple Creek Mine at Redcliff and the Buchwa Mine, about 200 kilometers southeast of Redcliff near Shabani. Buchwa was the principal source and supplied about 1 million tons of hematite ore grading 43% iron. Reserves were 20 million tons. Production at Ripple Creek was 300,000 tons per year of manganiferous iron ore grading 51.4% iron and 2.1% manganese. Proved reserves at Ripple Creek were 44 million tons, with an additional 100 million tons indicated. A study was under way to determine the feasibility of building a sintering plant at Redcliff to treat Ripple Creek ore. If successful, blast furnace feed would be 80% sinter in the ratio of 4 tons of Ripple Creek ore to 1 ton of Buchwa ore and 20% of lump ore.[10]

Nickel.—Nickel has been found in Zimbabwe in five different geologic environments: Hydrothermal shear-zone deposits, lateritic ore deposits, ultrabasic lava deposits, unlayered mafic intrusions, and layered mafic intrusions.[11] Output from hydrothermal shear-zone deposits terminated in 1957 with closure of the Noel Mine southeast of Bulawayo. Lateritic deposits, such as the Musengezi complex in the northern part of the Great Dyke, and layered mafic intrusions in the Great Dyke itself were under investigation for development. Nickel in ultrabasic lava flows at the Trojan Mine was in talc and serpentinite host rock, which was easy to mine, but costly to beneficiate. Nickel in unlayered mafic intrusions at the Madziwa Mine was in gabbroic or dioritic rock, which was difficult to drill and had erratic mineral distribution. Ore reserves in Zimbabwe were 60 million tons grading 0.6% to 1.2% nickel. Possible reserves of 2,000 million tons grading 0.25% nickel, 0.25% copper and 3 to 5 grams of combined platinum and palladium per ton of ore existed at the Hartley and Wedza complexes of the Great Dyke. In addition, nickel mineralization at Hunters Road near Que Que has been put at 15 to 20 million tons grading 0.75% nickel.

Primary nickel production was from six mines by three companies. BNC owned three mines, as well as the smelter at Bin-

dura operated by Bindura Smelting and Refinery Co. BNC was partly controlled by Anglo-American Corp. Rio Tinto (Zimbabwe) Ltd. owned two mines and a refinery at Eiffel Flats, Gatooma. The following tabulation gives primary nickel mines by year of development, as well as owners and operators.

Mine	Startup	Owner	Operator
Trojan	1964	Bindura Nickel Corp	Trojan Nickel Ltd.
Madziwa	1969	do	Madziwa Mines Ltd.
Empress	1971	Rio Tinto Zimbabwe Ltd	Empress Nickel Mining Co.
Perserverance	1972	do	Do.
Shangani	1975	Johannesburg Consolidated Investment Co. Ltd. (49%); Bindura Nickel Corp. (37%).	Shangani Mining Corp. Ltd.
Epoch	1976	Bindura Nickel Corp	Trojan Nickel Ltd.

Delays in development work at the Empress Mine because of poor ground stability as well as dilution and support problems encountered in early pillar removal resulted in a decline in tonnage and grade of ore produced. Production was also affected by a strike of 1,350 laborers in May. Mill throughput of 840,000 tons was planned for 1981 compared with 880,000 tons in 1980 and 934,000 tons in 1979. Rio Tinto (Zimbabwe) Ltd. acquired the remaining shares of Empress Nickel Mining Co. in what was essentially a rationalization of its interest in Zimbabwe.

Mining operations at the Shangani Mine have been highly sensitive to metal prices over the period of operations since 1976, and financial losses have been significant. The fiscal year ending June 30, 1980, was its first profitable year. Mill throughput was at the rate of 5 tons of open pit ore to 1 ton of underground ore following an underground development program. Production at both the Shangani Mine and the Trojan Mine was halted in November because of strikes.

Tin.—The Kamativi Mine east of Wankie continued to account for nearly all the tin output of Zimbabwe in 1980. The Industrial Development Corp. of Zimbabwe had a 91% controlling interest in Kamativi Tin Mines Ltd., which owned and operated the mine. Mill throughput was 60,000 tons per month of underground ore averaging 0.18% tin. New analytical equipment was being installed to enhance identification of tantalite bearing tin ore for exploitation. An exploration program aimed at documenting higher grade ore was under way. Development work was also being carried out for an opencast mine, which was to be brought into operation to reduce demands made on the underground workings.[12]

NONMETALS

Asbestos.—Shabani and Mashaba (Pvt.) Ltd., a subsidiary of Turner and Newall, operated the largest asbestos mining operation in Africa at Shabani, employing 4,300 people.[13] It also operated the Gaths, King, and Temeraire Mines east of Fort Victoria, which together with the Shabani Mine accounted for 90% of the country's total output of 260,000 tons in 1979. Chrysotile deposits at Shabani were located at the center of a 15-kilometer-long ultramafic sill, forming over 30 irregular shaped podlike ore bodies. Numerous minor faults and rock fractures cut the ore bodies and surrounding rock with considerable effect on rock competency. Both block caving and sublevel caving were the preferred mining methods, while the vertical crater retreat system of mining was being evaluated. Ore was accessed by two main shafts with a multi-level hoisting system employed to avoid gravity loading of asbestos ore through long ore passes. Initial rock assessment tests were initiated 11 years prior to main access development of a given ore block, with actual development of the block based on data from previously monitored blocks, rather than mathematical models. A new mill was activated at Shabani in September, built almost entirely by indigenous companies using locally supplied materials. Total mill throughput at Shabani was 2.4 million tons per year of new ore and 720,000 tons per year of reclaimed ore. Sizing and cleaning stages of asbestos fiber processing, followed by fluffing and blending, yielded a low-iron product for volume reduction and bagging. The Gaths and King mills had a combined throughput of 2.16 million tons per year, and the Temeraire mill had a

throughput of 480,000 tons per year of reclaimed material.

The Boss, Rex, Pangani and Vanguard Mines were operated by Pangani Asbestos Mines (Pvt.) Ltd., a subsidiary of Asbestos Investments Pty., Ltd. The Kudu Mine, an opencast mining operation, had a mill throughput of 360,000 tons per year. It was operated by Kudu Mines (Pvt.) Ltd., a subsidiary of Essexvale Asbestos (Pvt.) Ltd. The Thornwood Mine was owned and operated by A.D. Theron and Sons (Pvt.) Ltd., and the D.S.O. Mine was owned and operated by D.S.O. Asbestos (Pvt.) Ltd. The Ethel Mine, originally owned by Swedish interests, ceased operation in 1966 when markets for the mines' output were terminated. At the time of termination, the operating company had 11 production levels laid out, with each level having 4 years of ore supply.

Corundum.—Zimbabwe was the leading world producer of natural corundum, with output from only two mines. The major portion of output was in the form of boulder corundum produced at the O'Brien Mine near Concession. Reserves at the O'Brien Mine were reported at 60,000 tons, including both quarry and alluvial corundum. The alluvial deposit, with generally higher grade corundum, covered 72 acres and was mined by hand. Crystal corundum was produced at the Andrew alluvial claim, east of Chiredzi. Other deposits of corundum were located in the areas of Fungwi, Wedza, Mrewa, Beit Bridge, and Belingwe.

Graphite.—The Lynx Mine northwest of Karoi was the sole graphite producer, with an output of 5,760 tons in 1979. Operated by Rho German Graphite (Pvt.) Ltd., production had begun in 1966 at the rate of 4,800 tons per year. A new plant was under construction to increase output to 1,000 tons per month. The deposit was reported to contain high-grade flake graphite, with 26% to 28% carbon in ore. The final product after flotation was 90% to 92% carbon. Reserves were equivalent to 50 years at current levels of output, with 98% of production exported, mainly for use in foundry facings.[14] Other deposits have been found, as in the Dett area near Wankie, but have not been mined because of marketing problems.

Limestone.—Production of limestone, including dolomite and calcite, exceeded 1 million tons and was valued at nearly $4 million. Deposits were widely distributed throughout the country and were found mainly as lenticular masses in close conformity with banded ironstones of the Bulawayan Group. The most important source was the Early Worm Mine at Concession with vast reserves and high grade. A substantial portion of high-grade metallurgical limestone was consumed by the ferrochrome industry. Numerous other deposits were mined for local consumption. The Rushinga dolomite near Mount Darwin was reported as high grade, with reserves exceeding 100 million tons. The Sternblick deposit near Salisbury and the Colleen Bawn deposit near Gwanda were both used exclusively for cement manufacture. In the Mazoe Valley, the Pioneer lime works produced high-grade agricultural lime, and the Risco limestone was mined to supply the country's sole steel plant at Redcliff. The generally high iron content of domestic supplies required the importation of about $740,000 worth of burnt limestone. Expansion of the agricultural sector was expected to require about 500,000 tons of limestone annually.

Lithium.—Bikita Minerals (Pvt.) Ltd., a subsidiary of Selection Trust, operated the principal lithium deposit in Zimbabwe at Bikita, 67 kilometers east of Fort Victoria. Reserves at the deposit were reported at 8.1 million tons grading 1.4% lithium. About 230 people were employed at the site which produced petalite, spodumene, lepidolite, eucryptite, bikitaite, and amblygonite. Mining was concentrated in the Al Hayat quarry where the predominant mineral mined was petalite. Production was about 10,000 tons per month, with about 4,500 tons per month of salable product hand-sorted and stockpiled at the sorting plant. The remaining quantity was classed mainly as petalite rejects of low concentration and was stockpiled for possible future use as a chemical feed. A dry grinding plant employing a semiautogenous process was installed in 1978 to meet individual customer size specifications for marketable products.[15]

Magnesite.—Zimbabwe produced over 84,000 tons of magnesite in 1979, most of which was exported for production of refractory brick for use in the steel and copper industries. A small portion was calcined and ground for local use by Sable Chemical Industries Ltd. to produce fertilizer. All output was mined underground from a sedimentary deposit at Barton farm, southeast of Gatooma. Other occurrences included the Mat Mine, near Beit Bridge and the Calac deposit in the Nuanetsi area.

MINERAL FUELS

Coal.—The International Finance Corp. was assessing a loan requirement of $148 million to expand coal production at Wankie, the country's sole coal producer. Output was to be increased from the current level of about 3 million tons per year by the opening of a new mine producing high-ash coal. The major portion of the additional output, which was to commence in 1982, was planned to supply the first stage of a new coal-fired powerplant at Wankie, with an initial capacity of 480 megawatts. New coal production amounting to 4.5 million tons may be required from Wankie upon full completion of the powerplant with a capacity of 1,280 megawatts.

Strikes affected coal production in May and November, with as many as 4,000 of the 5,735 people employed at the site refusing to work. Limited quantities of coal were imported from the Republic of South Africa in May to make up the loss of coal supplied to steam engines caused by the strike.[16] Production from individual mines and sales in tons is listed in the following tabulation for years ending August 31 of the year stated:

	1979	1980
Underground mines: No. 3	1,126,430	1,122,248
Opencast mines:		
No. 1	164,668	99,309
No. 2	259,656	524,926
No. 2A	384,689	
No. 4	1,324,194	1,423,246
Total	3,259,637	3,169,729
Discards	491,655	617,393
Salable products	2,767,982	2,552,336
Used internally	385,783	331,032
Total coal sales	2,382,199	2,221,304

The No. 4 underground mine was to be opened in anticipation of depletion of No. 3 underground mine reserves. The No. 2 opencast mine reached the limit of overburden removal and was being replaced by No. 2A. Output from No. 1 opencast mine was used solely to supply customers with low phosphorus coal requirements. Total sales of coke were 235,168 tons compared with 201,471 tons in 1979.[17]

Petroleum.—The country's sole petroleum refinery at Umtali was evaluated for refurbishing and recommissioning, perhaps by 1982. The refinery remained inactive since the closure of its supply line, the Beira pipeline, in 1967. It originally processed light Iranian crude oil, with a capacity of 900,000 tons per year. Changes in feed material as well as product yield were anticipated as new fuel requirements were to be met. Output of regular gasoline from the Feruka refinery was expected to be blended with ethanol produced from sugarcane at Triangle. Zimbabwe, Mozambique, and seven oil companies were shareholders in the Feruka refinery.

The first ethanol plant in Zimbabwe went into production at Triangle in April 1980, using sugar as a feedstock. Fuel from the plant was blended with gasoline to produce a 15% ethanol-85% gasoline mixture.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Zimbabwe dollars (Z$) to U.S. dollars at the rate of Z$1.00=US$1.48.

[3]Monthly Digest of Statistics (Salisbury). February 1981, 48 pp.

[4]Falcon Mines Ltd. 71st. Annual Reports and Accounts For the Year Ended 30 Sept. 1980. 9 pp.

[5]Chamber of Mines Journal (Salisbury). Copper Resources of Zimbabwe. V. 23, No. 1, January 1981, p. 39.

[6]Harrison, N. M. Mineral Resources of Zimbabwe—an Overview. Zimbabwe Econ. Conf., Salisbury, September 1980, 19 pp.

[7]Mining Annual Review—1980 (London). Zimbabwe, pp. 501-502.

[8]Coronation Syndicate Ltd. Annual Report. Sept. 30, 1980. 20 pp.

[9]The Financial Gazette (Salisbury). RISCO Drives for Black Africa Trade. Dec. 19, 1980. P. 1.

[10]Metal Bulletin (London). Sinter Plant for RISCO? No. 6521, Sept. 9, 1980, p. 41.

[11]Clutten, J. M. Nickel Resources of Zimbabwe. Zimbabwe Econ. Conf., Salisbury, September 1980, 8 pp.

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[13]Shabani and Mashaba Mines (Pvt.) Ltd. History of Shabani Mine. Zimbabwe Econ. Conf., Salisbury, September 1980, 18 pp.

[14]Chamber of Mines Journal (Salisbury). The Industrial Minerals of Zimbabwe. V. 23, No. 2, February 1981, p. 47.

[15]Wegener, J. E. Lithium Minerals in Zimbabwe With Special Reference to the Operations at Bikita. Zimbabwe Econ. Conf., Salisbury, September 1980, 36 pp.

[16]U.S. Embassy, Pretoria, Republic of South Africa. State Department telegram 3365, May 14, 1980.

[17]Wankie Colliery Co. Ltd. 57th Annual Report 1980. P. 24.

The Mineral Industry of Other Central African Countries

By George A. Morgan[1]

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CAMEROON

The successful expansion of crude oil production begun in late 1977, led to promising development of the nonfuel minerals sector. Although actual production of nonfuel minerals was limited both in variety and in percentage of output on a world scale, the potential for expansion with a rapidly developing infrastructure was significant. The energy base was expanding with construction of two new hydroelectric powerplants in addition to the existing plant near Edea. The Song Loulou plant will have a 240-megawatt capacity, and a hydroelectric plant under construction in the northern part of the country by mainland China will have 72 megawatts of installed capacity.

Inflation of between 15% and 20% resulted in a real gross domestic product (GDP) of $2.8 billion[2] in fiscal year 1980 (July 31 to June 1), up 6% from that of the previous fiscal year. Petroleum became the leading export item in terms of value, surpassing coffee and cocoa exports. Mineral exports as a whole increased eightfold in value, mainly because of oil sales. Oil exports also caused a reduction in the trade deficit by nearly one-third, and the Government expected its 1980-81 budget to be balanced at $1.17 billion. The Port of Douala accounted for about 3 million tons of cargo, or 93% of total maritime traffic for Cameroon. Expansion plans for the port call for an initial increase to 5 million tons, and a cargo handling capacity of 7.5 million tons in 1985 and 10 million tons by 1990. The Port of Victoria will gain importance with the startup of an oil refinery. The country's third seaport at Kribi was used solely for timber shipments, and capacity at the Port was to triple by 1981. The Government operated its own shipping line with six oceangoing freighters. France was the dominant trading partner, accounting for 25%

and 45% of the value of Cameroon's exports and imports, respectively. The United States imported $186 million worth of crude oil from Cameroon in fiscal year 1980.

The aluminum smelter at Edea, operated by Campagnie Camerounaise de l' Aluminium Pechiney-Ugine, had a capacity of 62,000 tons per year. Alumina for the smelter was imported from Fria, Guinea. The facility utilized about 65% of the hydroelectric power generated, mainly from the powerplant at Edea. Proposals have been made to expand capacity to 80,000 tons per year at a cost of $120 million. The International Finance Corp. of the World Bank was to provide $100 million for the project. Power requirements for the expansion would be provided by a new hydroelectric plant nearing completion at Song Loulou with a capacity of 240 megawatts. Development of an estimated 1 billion tons of indigenous bauxite resources near Minim-Martap, about 100 kilometers south of Ngoundéré, was hampered by the continued lack of adequate transport capacity. Several international concerns have been interested in the deposits. A recently completed study indicated a cost of $300 million for upgrading the railroad and port system. The potential construction of an alumina plant at Kribi has also been considered in conjunction with exploitation of the deposits.

Small-scale tin production from alluvial deposits continued at Mayo Darlé in northwest Cameroon. Output has declined to less than 10 tons of tin in concentrate for export from the early 1940's when several hundred tons of tin in concentrate were produced. A feasibility study began on tin mining and the exploitation of other nonferrous metals in southwest Cameroon by the Bureau de Recherches Géologiques et Miniéres (BRGM) of France. The French Government and the European Development Fund were financing the project.

The fertilizer plant at Bonaberi, operated by Société Camerounaise des Engraise, resumed operations following several years of inoperation. Full production capacity was 90,000 tons per year of various fertilizer products, using imported raw material. About 200 people were employed at the plant.

Natural gas resources underwent appraisal for utilization in a liquefied natural gas (LNG) plant. Kribi has been proposed as the site of the project, as well as for a LNG shipping terminal. Sea floor studies were underway to determine the most favorable coastal channel for LNG tankers. Five offshore gas areas were converted from exploration permits to production concessions based on their commerical viability: Sandy-gaz, Kita-gaz, Kolé-gaz, Ekundu-gaz, and Bravo-gaz. Gulf Oil Co. announced the discovery of a large natural gas deposit near Douala. Additional drilling continued in the area to determine the deposit's commercial viability.

The Government established the state-owned Ste. Nationale de Hydrocarbures (SNH). SNH had a 60% share in offshore operations and 50% interest in all exploration permits. All production was by Société Nationale Elf Aquitaine, which completed development of two offshore fields. Output averaged 56,767 barrels per day in 1980, compared with an average of 34,466 barrels per day in 1979. Average daily production in 1981 was projected to be about 81,000 barrels. All crude oil output has been exported. An oil refinery, under construction since October 1978 near Victoria, will have an initial capacity of about 30,000 barrels of throughput per day. SNH will be the sole supplier of the refinery's feedstock, which will be about one-half of the company's share of total production. The remaining portion of the Government's allotment of crude oil will be available for export. SNH has 66% equity in the refinery and France has 10%; the remainder was divided evenly among four separate companies. Commissioning of the refinery, planned for 1981, will make Cameroon self-sufficient in refined products. Sales of refined products to the Central African Republic and Chad were also planned.

Table 1.—Other countries of Central Africa: Production of mineral commodities[1]

Country,[2] commodity,[3] and unit of measure	1976	1977	1978	1979[p]	1980[e]
CAMEROON					
Aluminum metal, primary—metric tons	57,724	55,593	48,620	43,200	43,000
Cement, hydraulic—do.	298,909	362,953	[e]350,000	489,560	500,000
Gold, mine output, metal content—troy ounces	251	182	[e]200	147	150
Petroleum, crude—thousand 42-gallon barrels	--	277	4,700	12,482	14,600
Pozzolana—metric tons	17,880	[e]17,880	17,500	NA	NA
Stone:					
Limestone—do.	60,463	91,135	79,180	80,000	NA
Marble—do.	638	678	[e]700	665	NA
Tin ore and concentrate:					
Gross weight—do.	19	21	[e]20	12	12
Metal content—do.	10	14	14	8	8
CENTRAL AFRICAN REPUBLIC					
Diamond:					
Gem[e]—carats	171,604	178,145	198,953	220,500	245,000
Industrial[e]—do.	114,403	118,764	85,266	94,500	105,000
Total—do.	[r]286,007	[r]296,909	284,219	315,000	350,000
Gold—troy ounces	[e]400	[e]100	[e]965	2,181	2,000
Uranium ore, metal content—kilograms	--	--	750	1,500	1,500
CHAD					
Sodium carbonate, natural (natron), slabs (plaques) and broken—metric tons	5,000	[e]11,000	11,000	[e]11,000	8,000
CONGO					
Cement, hydraulic—do.	52,000	[e]50,000	[e]50,000	[e]50,000	50,000
Copper, mine output, metal content—do.	408	1,011	800	1,000	1,300
Gas, natural:					
Gross[e]—million cubic feet	13,000	7,600	7,500	9,000	10,000
Marketed—do.	533	310	[e]300	[e]350	350
Gold, mine output, metal content[e]—troy ounces	6,900	7,000	7,000	7,000	7,000
Lead, mine output, metal content—metric tons	2,544	2,368	4,235	r e7,000	7,000
Petroleum, crude—thousand 42-gallon barrels	14,274	12,045	4,500	19,546	22,500
Potash, crude K_2O equivalent—metric tons	256,521	135,500	--	--	--
Zinc, mine output, metal content—do.	5,301	5,266	4,800	(4)	--

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Oct. 12, 1981.

[2]In addition to the countries listed, Equatorial Guinea and São Tomé e Principe, covered textually in this chapter, presumably produce modest quantities of a variety of crude construction materials (clays, stone, and sand and gravel), and may produce minor amounts of other mineral commodities (most notably gypsum, lime, and salt), but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[4]Revised to none.

Table 2.— Cameroon: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	7,244	30,518	--	France 22,571; Japan 5,096.
Semimanufactures	5,976	10,011	--	Ivory Coast 5,625; Gabon 1,358.
Copper metal including alloys, scrap	57	210	--	Belgium-Luxembourg 99; Netherlands 94.
Iron and steel metal:				
Scrap	801	2,552	--	Italy 2,514.
Semimanufactures	267	588	--	Italy 357; Gabon 184.
Lead metal including alloys, all forms	21	38	--	All to Italy.
Tin ore and concentrate	--	16	--	All to Spain.
Zinc metal including alloys, all forms	51	41	--	Belgium-Luxembourg 30.
NONMETALS				
Cement	172,326	2,742	--	Chad 1,135; Central African Republic 1,004.
Clays, crude	2	--		

Table 2.— Cameroon: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude	199	--		
Manufactured	43	61	--	Gabon 39; Chad 22.
Ammonia	--	2	--	All to Chad.
Lime	3	--		
Salt and brine	1,753	741	--	Chad 658; Nigeria 79.
Sodium and potassium compounds, n.e.s.: Caustic soda	--	118	--	Gabon 117.
Stone, sand and gravel	--	168	--	All to Chad.
Sulfur: Sulfuric acid, oleum	--	4	--	Gabon 3.
Other: Crude	106	8	--	All to Chad.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	1,803	13,303	9,715	Spain 1,392; France 1,349.
Refinery products:				
Gasoline 42-gallon barrels	68	9,716	--	Chad 4,904; Netherlands Antilles 2,278; France 1,284.
Kerosine and white spirit do	372	5,936	--	Chad 5,789.
Distillate fuel oil do	--	4,073	--	Chad 3,879.
Lubricants do	7,959	14,805	--	Gabon 11,613; Chad 2,366.
Unspecified do	35	196	--	Gabon 147.

Table 3.— Cameroon: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide	81,783	67,366	--	Guinea 67,183.
Metal including alloys:				
Scrap	--	14	--	Gabon 6; Congo 5.
Unwrought	97	755	--	France 750.
Semimanufactures	910	1,234	--	France 636; Ivory Coast 280; United Kingdom 175.
Chromium oxide and hydroxide	1	3	--	West Germany 2.
Cobalt oxide and hydroxide value, thousands	$4	$5	--	All from Netherlands.
Copper:				
Matte do	--	$1	--	All from France.
Metal including alloys, all forms	162	423	1	United Kingdom 242; France 136.
Iron and steel:				
Ore and concentrate excluding roasted iron pyrites	--	42	--	All from China, mainland.
Metal:				
Scrap	44	8	--	Nigeria 5.
Pig iron including cast iron	185	588	100	France 487.
Sponge iron, powder, shot	18	28	--	All from France.
Ferroalloys	11	8	--	Do.
Steel, primary forms	14,006	18,836	--	West Germany 10,644; France 5,967.
Semimanufactures:				
Bars, rods, angles, shapes, sections	28,975	32,487	1	France 19,023; Canada 4,604.
Universals, plates, sheets	11,516	20,881	488	France 14,898; Japan 2,676.
Hoop and strip	2,070	790	74	West Germany 277; United Kingdom 195; France 105.
Rails and accessories	783	1,734	--	France 1,659.
Wire	4,915	6,134	--	France 5,844; West Germany 72.
Tubes, pipes, fittings	28,258	35,165	62	France 27,369; Japan 3,109.
Lead:				
Oxide	68	80	--	France 70.
Metal including alloys, all forms	10	11	--	France 10.
Magnesium metal including alloys, all forms	123	269	226	France 43.

Table 3.— Cameroon: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate	2	2,516	--	All from Gabon.
Oxide	--	3	--	France 2.
Nickel metal including alloys, all forms	2	30	--	Mainly from Belgium-Luxembourg.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$6	$21	--	Hong Kong $14; France $7.
Silver metal including alloys, unwrought and partly wrought do.	$28	$16	--	France $13; United Kingdom $3.
Tantalum metal including alloys, all forms do.	--	$1	--	All from West Germany.
Tin metal including alloys, all forms	48	42	--	United Kingdom 37.
Titanium oxide	78	61	--	United Kingdom 30; France 27.
Tungsten metal including alloys, all forms value, thousands	$1	--		
Zinc:				
Oxide and peroxide	36	32	--	France 31.
Metal including alloys, all forms	14	31	--	France 27.
Other:				
Ores and concentrates	(1)	139	--	All from Sweden.
Ash and residue containing nonferrous metals	--	14	--	Gabon 6; Congo 5.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	1	18	--	France 15.
Artificial corundum	17	23	--	All from France.
Grinding and polishing wheels and stones	54	55	--	France 33.
Asbestos, crude	34	43	40	Austria 3.
Barite and witherite	15,750	25,903	--	Morocco 11,300; Ireland 6,917; Italy 4,008.
Boron materials:				
Crude natural borates	6	108	--	All from France.
Oxide and hydroxide	11	14	--	France 10.
Cement	302,603	361,253	--	France 312,618; Italy 35,092.
Chalk	1,379	5,199	--	France 5,184.
Clays and clay products:				
Crude	2,969	5,336	320	Spain 3,157; France 1,336.
Products:				
Refractory including nonclay brick	1,558	3,701	--	France 3,058; West Germany 318.
Nonrefractory	4,950	4,831	--	Italy 2,118; France 1,100; China, mainland 518.
Diamond:				
Gem, not set or strung value, thousands	$1	$1	--	All from France.
Industrial do.	--	$7	--	Japan $5; France $2.
Diatomite and other infusorial earth	605	685	81	France 501; Belgium-Luxembourg 70.
Feldspar, fluorspar, etc	50	50	--	All from France.
Fertilizer materials:				
Crude, potassic	7,146	9,000	--	Spain 8,700.
Manufactured:				
Nitrogenous	61,086	36,588	--	Spain 10,618; Finland 7,500; Netherlands 5,000.
Phosphatic	5,041	5,012	60	West Germany 1,750; France 1,350; Spain 1,000.
Potassic	4,148	4,820	--	Spain 3,000; West Germany 1,517.
Other including mixed	9,699	688	--	All from France.
Ammonia	73	146	--	France 72; Netherlands 46.
Graphite, natural	--	7	--	Austria 6.
Gypsum and plaster	20,867	12,284	--	Spain 6,622; Morocco 5,200.
Lime	1,910	2,771	--	France 2,195; Spain 480.
Magnesite	--	1	--	All from France.
Mica:				
Crude including splittings and waste	10	35	--	France 25; United Kingdom 10.
Worked including agglomerated splittings value, thousands	$2	$8	--	All from France.

See footnote at end of table.

Table 3.— Cameroon: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Pigments, mineral:				
Natural, crude	76	41	--	Nigeria 22; France 19.
Iron oxides, processed	53	85	--	West Germany 37; France 33.
Precious and semiprecious stones, except diamond value, thousands	--	$27	--	Switzerland $26.
Pyrites	25	4	--	All from West Germany.
Salt and brine	29,455	43,296	--	Senegal 29,415; Spain 9,131; Italy 3,800.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	5,525	7,316	--	France 1,940; Italy 1,360; Spain 1,211.
Caustic potash	216	217	--	United Kingdom 185.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	551	200	--	Italy 186.
Worked	147	724	--	Italy 370; Greece 156; China, mainland 118.
Calcareous stone	541	592	--	All from France.
Dolomite, chiefly refractory-grade	808	881	--	Do.
Gravel and crushed rock	70	126	--	France 74; Italy 52.
Quartz and quartzite	53	23	--	Belgium-Luxembourg 20.
Sand excluding metal-bearing	190	461	--	France 282; Netherlands 176.
Sulfur:				
Elemental, all forms	26	11,207	--	All from France.
Sulfuric acid, oleum	288	394	--	Belgium-Luxembourg 192; Netherlands 181.
Talc, steatite, soapstone, pyrophyllite	346	297	--	France 259.
Other:				
Crude	731	1,044	36	Chad 740; Sweden 188.
Slag, dross, and similar waste, not metal-bearing	108	2	--	All from China, mainland.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	(1)	2	--	All from France.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	622	728	--	France 392; Austria 102.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	98	389	--	United Kingdom 361.
Carbon black	522	370	--	France 357.
Coal, all grades including coke and briquets	260	332	196	France 76; Poland 45.
Petroleum and refinery products:				
Crude and partly refined 42-gallon barrels	30	15	--	All from Nigeria.
Refinery products:				
Gasoline thousand 42-gallon barrels	653	1,432	--	Gabon 606; Netherlands 247; Italy 204.
Kerosine and white spirit do.	742	1,005	--	Netherlands 399; Netherlands Antilles 153; France 149.
Distillate fuel oil do.	1,059	1,995	--	Gabon 804; Netherlands 381; Netherlands Antilles 258.
Lubricants do.	112	57	(1)	France 21; Spain 16.
Mineral jelly and wax do.	4	4	(1)	West Germany 1; Netherlands 1.
Liquefied petroleum gas do.	47	59	(1)	Italy 18; France 16.
Unspecified do.	203	221	18	West Germany 125; Netherlands Antilles 69.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	232	383	--	United Kingdom 350.

[1]Less than 1/2 unit.

CENTRAL AFRICAN REPUBLIC

Mineral production in 1980 was limited to diamonds and a small output of gold and mainly test shipments of uranium ore. Diamonds replaced coffee as the country's principal export commodity in 1978 and continued to dominate the overall economy in 1980. In 1979, nearly 41% of the value of exports, or $43 million,[3] was provided by diamonds. The high ratio of gem to industrial diamonds significantly affected the value.

The national debt increased to $287.8 million, and the Government was heavily dependent upon foreign loans and grants. The 1980-81 recovery plan was comprised of investments totaling $200 million, of which the mining sector was allocated $5.4 million. Of this amount, $4.8 million was to cover the cost of a pilot plant in France for the treatment of uranium ore mined from the Bakouma deposit.[4] The Société de l'Uranium Centrafricain, formed in 1975, had exclusive uranium mining rights in the Central African Republic.

Diamond production increased by 11% in 1980. Diamond Distributors International of the United States operated the domestic diamond cutting industry in conjunction with the Government of the Central African Republic through Comptoir National du Diamant. The Central African Mining Exploitation Co. was granted exploration and exploitation permits for gold and diamonds in several regions, including the western diamond-bearing region. Prospecting permits were valid for 5 years; exploitation permits were issued for 4 years.

Financing was being sought for development of the Fatima-Bobosa limestone deposit. Limestone from the deposit would be used to supply the country's first cement plant. Proposed development of an iron ore deposit in Bogoin was postponed in view of the current state of disarray of the economy and was expected to be reexamined in the 5-year plan for 1982-86.

Continental Oil Co., which had oil discoveries in Chad, continued exploration in the northern region close to the Chadian border.

Table 4.—Central African Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
Aluminum metal including alloys, semimanufactures	2	--		
Diamond: Gem, not set or strung value, thousands	$26,881	$35,019	$6,492	Belgium-Luxembourg $16,577; United Kingdom $1,564; Netherlands $1,072.
Industrial do.	$89	--		
Hydrogen, helium, rare gases	14	5	--	All to Chad.
Iron and steel metal, semimanufactures value, thousands	$1	--		
Salt	5	--		
Sodium and potassium compounds, n.e.s.: Caustic soda	--	47	--	All to Chad.

Table 5.—Central African Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, unwrought and semimanufactures	21	27	--	All from France.
Copper metal including alloys, unwrought and semimanufactures	7	1	--	Do.
Iron and steel metal:				
Pig iron, ferroalloys, similar materials	--	1	--	Do.
Semimanufactures	2,280	940	(1)	France 894; Spain 21; Italy 12.

See footnotes at end of table.

Table 5.—Central African Republic: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxide	--	9	--	All from France.
Metal including alloys, unwrought and semimanufactures	1	--		
Silver metal including alloys, unwrought and partly wrought value, thousands	$1	$1	--	All from France.
Tin metal including alloys, unwrought and semimanufactures do	$3	$3	$1	France $1.
Titanium oxide	13	24	--	Netherlands 17; France 7.
Zinc:				
Oxide and peroxide	--	1	--	All from France.
Metal including alloys, unwrought and semimanufactures	--	1	--	Do.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	9	2	--	Mainly from France.
Barite	19	19	--	All from France.
Cement	9,933	8,193	--	Zaire 8,172; France 21.
Chalk	63	35	--	France 18; Zaire 17.
Clays and clay products:				
Crude	30	--		
Products:				
Refractory including nonclay brick	7	--		
Nonrefractory	208	294	--	France 223; Italy 53; Spain 17.
Diatomite and other infusorial earth	--	52	--	All from France.
Fertilizer materials:				
Manufactured:				
Nitrogenous	--	673	--	Do.
Phosphatic	--	295	--	Do.
Potassic	10	80	--	Do.
Ammonia	4	3	--	Do.
Gypsum and plasters	3	1	--	Do.
Lime	65	25	--	Do.
Pigments, mineral: Processed iron oxides	2	2	--	Do.
Salt	3,573	4,204	--	Guinea-Bissau 3,072; France 646; Portugal 457.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	254	91	--	All from France.
Caustic potash	1	--		
Stone, sand and gravel:				
Dimension stone, worked	36	80	49	France 31.
Dolomite, chiefly refractory-grade	34	32	--	All from France.
Gravel and crushed rock	--	2	--	Do.
Sulfur: Sulfuric acid, oleum	8	13	--	France 7; Netherlands 6.
Talc, steatite, soapstone, pyrophyllite	5	5	--	All from France.
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	41	20	--	Do.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	118	5	--	Do.
Coal, all grades including coke and briquets value, thousands	--	$3	--	Mainly from Hong Kong.
Hydrogen, helium, rare gases do	--	$3	$1	France $2.
Petroleum refinery products:				
Gasoline 42-gallon barrels	162	5,508	8	Netherlands 5,449; France 1.
Kerosine do	--	31	--	All from France.
Distillate fuel oil do	4,008	5,670	37	France 3,178; Trinidad and Tobago 1,000; Brazil 798.
Lubricants do	2,702	4,606	21	Ivory Coast 2,800; France 665; United Kingdom 476.
Mineral jelly and wax do	79	--		
Liquefied petroleum gas do	1,496	1,520	NA	France 766; Italy 557; United Kingdom 70.
Unspecified do	7,217	13,587	--	Spain 13,153; France 189; Netherlands Antilles 140.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1	--		

NA Not available.
[1]Less than 1/2 unit.

CHAD

The only mineral production of significance in 1980 was natron, a hydrous sodium carbonate derived from brines and evaporite deposits at Lake Chad. Output of salt, clays, and building materials occurred in limited quantities for local consumption. Open civil war between several factions disrupted the major portion of the country, and heavy fighting in the capital led to evacuation by large numbers of Chadian citizens and most foreign personnel. The war continued to forestall development of the country's fledgling petroleum industry, which was expected to be capable of supplying local demand through the construction of a small refinery. Oil has been discovered at Kanem, north of Lake Chad, and near Moundou in southwestern Chad. The area south of the Chari River continued to be an oil exploration target. Consumption was about 1,100 barrels per day of refined oil products. Diesel fuel was the main fuel import item to power generators located in Ndjamena, Sarh, Moundou, and Abeche. The fuel supply to Chad was mainly from Nigeria, passing overland through northern Cameroon. Because there was no refinery, pipeline terminal, or national stocks, supplies of fuel oil amounted to only about 2 months' stocks located at power generator sites. Fuel transport was generally nonexistent during the rainy season.

CONGO (PEOPLE'S REPUBLIC OF THE)

In 1980, output of crude oil again increased and was the country's principal export item. The GDP was estimated at $1.3 billion.[5] Government revenue amounted to $567 million, of which petroleum accounted for 60%. The economy in general was in poor financial condition. Production and distribution of products, which were the responsibility of state organizations with import monopolies, were erratic. Marketing of cement was paralyzed at times. Production of nonfuel mineral commodities was relatively insignificant, but several mining projects were slated for rehabilitation.

The ABF Mining Co. of the United States negotiated with the State Mining Corp. for reopening the Holle potash mine. Potash production would be exported to the United States. The mine was closed in June 1977 following flooding because of a rupture of the overlying dolomite aquifer. Output from the mine has been as high as 240,000 tons of crude potash, K_2O equivalent, per year. The lead and zinc mining sector was to receive assistance from the U.S.S.R. A new lead-zinc find was reported near Mfouati, which was the location for existing production. The concentrator at Mfouati was only operating at 25% of its 30,000-ton-per-year rated capacity. Soviet assistance was also expected for development of an iron deposit at Zanago, which contained 1 billion tons of ore grading 50% iron.

A strike by workers of the manganese mine at Mbinda in Gabon in February led to a decline in transport earnings by Chemin de Fer Congo in 1980.[6] Shipment of other mineral-related commodities included 44,000 tons of cement and 178,000 tons of mixed fuels. The European Economic Community granted a loan of $8.9 million for completion of modernization and realinement of the railroad.

Crude oil was produced from four areas in 1980. Production from Pointe-Indienne, the only onshore deposit, was small, and the deposit was nearly exhausted. Main production was from Emerande, where 1.4 million tons was recovered. Of a total recoverable amount of 17 million tons at Emerande, 13 million tons had been produced by yearend 1979. Output at Loango was 1.3 million tons, and production from Lekouala Marine, which commenced output in April, was estimated to be 500,000 tons in 1980. Two companies produced oil in the Congo, Elf Congo and Azienda Generale Italiani Petroli S.p.A. The state-controlled Hydro-Congo held 20% of the capital of both companies. Government participation was to increase with higher production levels. A grant of $5 million was received from the International Development Association for the services of petroleum specialists as well as a training program and survey.

Table 6.—Congo: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, scrap	NA	4	--	France 2.
Copper metal including alloys, scrap	NA	37	--	West Germany 28; France 9.
Iron and steel metal:				
Scrap	NA	87	--	Mainly to Benin.
Semimanufactures	623	133	--	Italy 85; Netherlands 46.
Lead ore and concentrate	9,656	1,546	--	All to Switzerland.
Manganese ore and concentrate	176,824	--		
NONMETALS				
Diamond: Gem, not set or strung value, thousands	$5,051	$8,824	$86	Belgium-Luxembourg $4,948; Netherlands $2,795.
Fertilizer materials, manufactured	282,702	37	--	All to France.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	NA	40	--	Do.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum and refinery products:				
Crude thousand 42-gallon barrels	8,981	8,208	803	Italy 3,902; Brazil 2,243; Spain 1,259.
Refinery products: Kerosine do	56	26	--	All for bunkers.

NA Not available.

Table 7.—Congo: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	82	70	1	Netherlands 37; France 20.
Copper metal including alloys, all forms	NA	16	(1)	France 15; West Germany 1.
Iron and steel metal:				
Scrap	NA	938	--	Mainly from Italy.
Pig iron, ferroalloys, similar materials	NA	78	--	All from France.
Steel, primary forms	NA	1	--	Do.
Semimanufactures:				
Bars, rods, angles, shapes, sections	3,940	4,594	2	France 3,002; Italy 959; Mozambique 245.
Universals, plates, sheets	1,832	3,619	--	France 2,582; Japan 901.
Hoop and strip	NA	41	--	France 33; Italy 6.
Rails and accessories	11,883	1,315	--	France 1,272; United Kingdom 43.
Wire	286	376	--	Senegal 182; Belgium-Luxembourg 100; France 40.
Tubes, pipes, fittings	2,612	1,572	2	France 1,377; Italy 120.
Lead:				
Oxide	NA	3	--	All from France.
Metal including alloys, all forms	NA	1	--	Do.
Nickel metal including alloys, all forms	NA	1	--	Do.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	NA	$3	--	Do.
Silver metal including alloys, unwrought and partly wrought do	NA	$3	--	Do.
Tin metal including alloys, all forms	NA	17	--	Do.
Titanium oxide	NA	48	--	All from Netherlands.
Zinc metal including alloys, all forms	NA	5	--	All from France.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	69	27	--	France 18; Switzerland 8.
Barite and witherite	NA	65	--	All from France.
Cement	46,254	15,594	--	Zaire 11,625; Belgium-Luxembourg 3,326.
Chalk	NA	309	--	France 204; Zaire 105.
Clays and clay products:				
Crude	NA	802	--	France 650; Senegal 152.

See footnotes at end of table.

Table 7.—Congo: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products —Continued				
Products:				
Refractory including nonclay brick	96	333	--	All from France.
Nonrefractory	465	798	--	France 372; Italy 171; China, mainland 115.
Diatomite and other infusorial earth	NA	152	--	Mainly from France.
Fertilizer materials:				
Crude	NA	123	--	East Germany 100; France 20.
Manufactured	NA	1,240	--	Romania 1,200; France 40.
Ammonia	NA	8	--	France 7; Ivory Coast 1.
Gypsum and plasters	NA	203	--	Mainly from Zaire.
Lime	NA	127	--	France 97; Belgium-Luxembourg 30.
Pigments, mineral: Processed iron oxides	NA	13	--	France 7; Italy 5.
Salt and brines	2,806	4,285	--	West Germany 1,317; Senegal 992; Portugal 859.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	NA	1,404	--	France 1,163; United Kingdom 140.
Caustic potash, sodic and potassic peroxides	NA	7	--	Mainly from East Germany.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	NA	4	--	All from Zaire.
Worked	NA	28	--	Mainly from Italy.
Gravel and crushed rock	NA	5	--	All from France.
Sand excluding metal-bearing	NA	123	--	All from Netherlands.
Sulfur: Sulfuric acid, oleum	NA	68	--	France 35; Italy 14; West Germany 9.
Talc, steatite, soapstone, pyrophyllite	NA	69	--	All from France.
Other:				
Crude	NA	203	--	Mainly from Zaire.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	NA	58	--	France 54; Netherlands 2; United Kingdom 2.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	NA	4	--	All from France.
Coal, all grades including coke and briquets	NA	104	--	Mainly from France.
Petroleum and refinery products:				
Crude—42-gallon barrels	NA	560,942	--	All from Italy.
Refinery products:				
Gasoline—do	8,628	106,633	--	All from Brazil.
Kerosine—do	6,022	90,760	--	Mainly from Brazil.
Distillate fuel oil—do	53,645	213,199	--	Do.
Residual fuel oil—do	NA	17,862	--	All from Brazil.
Lubricants—do	8,141	16,163	133	Netherlands 10,990; France 2,674; U.S.S.R. 1,428.
Liquefied petroleum gas—do	NA	14,198	--	France 12,957; Netherlands 1,241.
Unspecified—do	6,006	973	231	Italy 371; Netherlands 273.

NA Not available.
[1]Less than 1/2 unit.

EQUATORIAL GUINEA

The economy, in a state of collapse in 1979, stagnated in 1980 while a new Government attempted to bring stability to the country. Substantial foreign assistance was required for rehabilitation of the transportation, farming, and electric power sectors. Although no mineral production was officially recorded for Equatorial Guinea, output of small quantities of materials such as clays, sand, and possibly salt presumably occurred. The prospects for future mineral industry development were under evaluation through the efforts of several foreign entities. BRGM conducted exploration studies in Rio Muni, particularly for uranium. France was also financing a hydroelectric powerplant for the country and had provided $2.4 million by late 1979 to promote development of fishing, mineral prospecting, and repair of the port facilities at Molabo. Mineral-related activities included the training of local personnel and providing technical mineral prospecting expertise.

The U.S.S.R. supplied oil to Equatorial

Guinea at below world prices. Empresa Guineo Española de Petróleos (GERSA), controlled equally by Hispanoil of Spain and the Government of Equatorial Guinea, was granted four sectors on the Continental Shelf northeast of Bioko Island for oil exploration. GERSA was to invest $24.25 million over the next 3 years for oil exploration. New petroleum and mining laws were being formulated. All mineral deposits, including petroleum, were expected to be the property of the state.

SAO TOME E PRINCIPE

In 1980, both foreign aid and domestic economic policy were directed at the agricultural sector, primarily for the purpose of reducing expensive food imports. French, Portuguese, and Chinese aid has been mainly in the areas of agriculture and medicine. The U.S.S.R., Cuba, and the German Democratic Republic have provided political and military assistance to the country's single political party. The German Democratic Republic was also constructing a ceramic factory. No new developments occurred in the oil and gas exploration sector, where there was only one permit holder.

In July 1980, Decree Law No. 30-80, relating to foreign investment in São Tomé e Principe, went into effect.[7] Many sectors were excluded from foreign ownership or participation, such as foreign trade, telecommunications, insurance, and news media. Private enterprises, mixed companies, and partnership associations were allowed to form. Mixed enterprises, with few exceptions, had to be 51% owned by São Tomean principals. Associations could be formed for the purpose of importing capital, equipment, or technology, but they would not have the status of a corporation. The transfer abroad of annual profits was allowed. The decree law did not rule out nationalization of an enterprise. However, indemnification of the enterprise was guaranteed and could not be less than the value invested less the portion of the value already reimbursed. Exemption from taxes on earnings during the first few years of activity and reduction in or exemption from customs duties was possible. Both the exportation and importation of products and equipment were to be conducted in close association with the State Foreign Trade Enterprise.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Communité Financiére Africaine francs (CFAF) to U.S. dollars at the rate of CFAF225.80=US$1.00 for 1980, and CFAF201.00=US$1.00 for 1979.

[3]See footnote 2.

[4]Industries et Travaux D'Outre-Mer, Paris. Details of Economic Recovery Plan 1980-1981. June 1980, pp. 354-355.

[5]See footnote 2.

[6]Industries et Travaux D'Outre-Mer, Paris. Congo. April 1981, p. 228.

[7]Diario Da Republica, São Tomé. Regulations on Foreign Investment Published. Aug. 5, 1980, pp. 264-267.

The Mineral Industry of Other East African Countries

By Suzann C. Ambrosio[1]

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BURUNDI

The mineral industry in Burundi continued to be a minor contributor to the 1980 gross domestic product (GDP) estimated at $293 million in constant 1970 prices.[2] Mineral export revenues, primarily from cassiterite, increased by a factor of 15 between 1979-80, reaching approximately $430,000 by yearend 1980. Gold, bastnäsite, colombite-tantalite, and wolframite continued to be exploited on a small scale, using manual and semimechanical methods. Despite a sharp decline in mining activities during 1979, attributed to a lack of profitability and shortage of construction materials, the mining sector exhibited signs of recovery during 1980.

The mineral exploration budget grew 32% over 1979 levels and was equivalent to approximately $42,000 in 1980. In addition, the Burundi Geographical Institute (IGEBU) was created in September 1980 and given responsibilities to collect cartographic, topographic, hydrogeologic, and other geomorphological data.[3] SONIBUROM, the Burundian and Romanian Government joint mineral corporation, conducted mineral deposit inventories during 1979-80 and has been charged with exploiting some of these as yet unspecified resource areas. Another Burundian-Romanian effort, called Mabaya-Butahana, was initiated to search for gold deposits. Meanwhile on the Ruzizi plain, alluvial gold prospecting, with an estimated grade between 0.2 to 1.0 gram per ton, was carried out on a small scale.

Remote sensing surveys have identified possible iron, titanium, and vanadium deposits near Kinganda, in the Buhoro region. In the Butara-Bubanza-Masango area, potential uranium mineralization was investigated and drilling programs were planned. Drilling was initiated in the Matongo-Bandaga area in the Ngozi Province to evaluate limestone and phosphate deposits. Plans were made by the Burundi National Lime and Cement Making Co. to expand production capacity through the installation of a 50-ton-per-day lime kiln.

Progress was made on the nickel laterite project, and prefeasibility studies were prepared. The deposit with the greatest exploitation potential was located in the Buhinda

sector at Musongati. The nickel ore reserves were estimated to contain 73 million tons with an average grade of 1.6% nickel, 0.1% cobalt, and 0.3% copper. Approximately 30 million tons were thought to be higher grade ores, averaging 2% nickel. Development of a 2-million-ton-per-year open pit mining operation was under consideration, and metallurgical processing alternatives were investigated.

Large infrastructure costs were projected for the nickel project, and the construction of new transportation and port facilities required the cooperation of at least one neighboring country. Potential energy from hydroelectric or peat resources was considered available in the Musongati area. Development of a 500-million-ton peat deposit in the Akanyaru region, 110 kilometers away, was being considered. The nickel project was expected to enter the detailed feasibility phase during 1981.

Several multilateral and unilateral aid programs have helped to finance Burundi development projects. The average external aid granted over the period 1977-81 was estimated at $57 million. The United Nations and World Bank programs were estimated to provide nearly 30% of the total. A slight decrease in aid was projected for 1980, and by yearend, both the Government deficit and balance-of-trade deficit increased to approximately $18 million and $92 million, respectively. This was largely attributed to bottlenecks caused by crane difficulties at the Port of Bujumbura, a concurrent decline in coffee and cotton export revenues, and the near doubling of the petroleum import bill to $25 million by yearend 1980.

Table 1.—Other countries of East Africa: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Country and commodity	1976	1977	1978	1979[p]	1980[e]
BURUNDI[2 3]					
Clays: Kaolin	2,362	e2,500	e2,750	e2,750	2,750
Columbium and tantalum ores and concentrates, kilograms	4,000	e4,000	--	2,100	2,100
Gold, troy ounces	426	e450	e450	133	130
Lime	622	e600	e200	e200	200
Peat	--	--	2,000	9,000	9,000
Rare-earth metals: Bastnäsite concentrate, gross weight	139	e140	NA	30	30
Tin ore and concentrate:					
Gross weight	26	e30	e30	17	20
Metal content	17	e20	e20	8	10
Tungsten, metal content	2	e2	e2	--	--
ETHIOPIA[2]					
Cement, hydraulic	148,500	r e73,000	86,000	92,757	95,000
Clays: Kaolin	45,000	e40,000	31,750	30,000	30,000
Coal: Lignite[e]	200	200	--	--	--
Copper:					
Gross weight	1,900	--	--	--	--
Metal content	e400	--	--	--	--
Gold, mine output, metal content, troy ounces	11,253	7,725	e8,000	7,970	9,000
Gypsum and anhydrite, crude	--	6,552	932	925	900
Petroleum refinery products:					
Gasoline, thousand 42-gallon barrels	672	733	782	683	700
Jet fuel and kerosine, do.	198	--	240	210	200
Distillate fuel oil, do.	1,451	1,586	1,470	1,095	1,100
Residual fuel oil, do.	1,471	1,498	1,698	2,021	2,000
Other, do.	91	152	152	114	100
Refinery fuel and losses, do.	454	601	453	265	300
Total, do.	4,337	4,570	4,795	4,388	4,400
Platinum, mine output, metal content, troy ounces	145	100	123	108	120
Pumice, cubic meters	NA	5,000	NA	4,590	4,600
Salt:					
Rock[e]	10,000	5,000	10,000	15,000	15,000
Marine	88,000	e75,000	50,000	92,737	90,000
Stone, sand and gravel:					
Limestone	8,500	e8,500	e7,000	7,308	8,000
Sand, cubic meters	NA	219,471	e90,000	97,200	100,000
Other, do.	NA	959,180	e280,000	383,940	375,000

See footnotes at end of table.

Table 1.—Other countries of East Africa: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Country and commodity	1976	1977	1978	1979[p]	1980[e]
LESOTHO[2]					
Diamond:					
Gem ---------- carats	891	7,576	[e]14,333	[e]10,484	10,743
Industrial ---------- do	4,125	34,514	[e]57,332	[e]41,937	42,971
Total ---------- do	5,016	42,090	71,665	52,421	[4]53,714
Stone ---------- cubic meters	NA	18,572	25,000	[e]25,000	25,000
MALAWI[2]					
Cement, hydraulic ---------- thousand tons	85	94	103	113	[4]92
Gem and ornamental stone: Agate[e] ----------	4	4	4	6	NA
Kyanite ----------	[e]90	250	100	--	--
Lime ----------	250	--	--	--	--
Stone: Limestone ----------	149,254	116,653	155,229	168,604	[4]122,814
MAURITIUS[2]					
Lime ----------	7,300	7,500	8,000	[e]8,000	8,000
Salt ----------	5,500	6,000	6,000	[e]6,000	6,000
Stone: Basalt, not further described ----------	400,000	1,574,000	1,154,885	970,000	1,000,000
RWANDA[2]					
Beryllium: Beryl concentrate, gross weight ----------	46	[e]55	58	46	[4]108
Columbium and tantalum ores and concentrates:					
Columbite-tantalite, gross weight ----------	45	64	48	47	[4]60
Gas, natural:					
Gross ---------- million cubic feet	6	7	7	--	--
Marketed ---------- do	6	7	7	--	--
Gold, mine output, metal content troy ounces	936	1,814	1,125	472	[4]944
Lithium minerals: Amblygonite[e] ----------	30	30	28	28	NA
Tin, mine output, metal content ----------	1,605	1,598	1,502	1,500	[4]1,600
Tungsten, mine output, metal content ----------	432	568	385	401	[4]354
SEYCHELLES[2]					
Guano ----------	5,670	5,277	5,505	[e]5,600	5,600
SOMALIA[2]					
Salt, marine[e] ----------	2,000	2,000	2,000	2,000	2,000
SWAZILAND[2 5]					
Asbestos: Chrysotile ----------	41,847	38,046	36,957	34,294	[4]32,833
Barite ----------	369	--	--	--	--
Clays: Kaolin ----------	989	--	--	--	--
Coal: Bituminous ----------	154,525	128,990	165,874	168,409	[4]175,984
Iron ore, direct-shipping grade, gross weight thousand tons	1,744	1,441	1,266	--	--
Stone: Quarry product ---------- cubic meters	50,618	93,490	452,494	247,090	[4]74,045
Tin, mine output, metal content ----------	2	2	1	--	--
UGANDA					
Beryllium: Beryl concentrate, gross weight[e] ----------	[r]54	45	NA	--	--
Bismuth, mine output, metal content[e] kilograms	5,000	3,000	1,000	5,000	NA
Cement, hydraulic ----------	87,600	80,000	[e]80,000	50,000	NA
Columbium and tantalum ores and concentrates, gross weight[e] ---------- kilograms	2,100	2,100	2,058	2,260	NA
Copper:					
Mine output, metal content ----------	7,000	4,000	--	--	--
Metal, blister, primary ----------	7,000	3,277	--	--	--
Iron and steel: Crude steel ----------	[r]12,000	15,000	15,000	--	--
Lime, hydrated and quicklime[e] ----------	20,000	20,000	25,000	28,000	27,000
Phosphate minerals: Apatite ----------	15,000	5,000	5,000	--	--
Salt, evaporated[e] ----------	500	500	500	500	515
Tin, mine output, metal content[e] ----------	120	120	120	60	50
Tungsten, mine output, metal content ----------	110	110	110	[e]55	50

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Oct. 12, 1981.

[2]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3]Limited quantities of other pegmatite minerals may also be produced, but output is not reported.

[4]Reported figure.

[5]Data represent sales; actual production is not reported.

DJIBOUTI

Stategically located between Somalia and Ethiopia, Djibouti controlled the coastal access to the Bab el Mandeb Strait, which connects the Red Sea with the Indian Ocean (Gulf of Aden). Djibouti was not endowed with natural resources, and only small amounts of construction materials were exploited. During 1980, Iraq granted Djibouti a loan worth $25 million to establish a cement facility. France was installing a solar pump for irrigation purposes at yearend 1980. Future solar energy and possible hydroelectric applications were being considered for Assual Lake and Goubed Bay. Additional expenditures were expected to improve and modernize the Port of Djibouti and increase water, health, and education services.

Djibouti depends on foreign economic and technical assistance, and roughly $120 million was committed during 1979-81. France, Saudi Arabia, Iraq, and Kuwait were the major unilateral aid donors. The European Development Fund has consistently provided the largest share of financial and technical assistance since the country's independence in 1977. Increased aid has allowed for the near 25% expansion of the 1981 proposed budget. Additional revenues were projected to be furnished through direct taxes (25%) and indirect taxes (75%). The public debt was estimated to comprise only 2% of the Government expenditures in 1980. The current and proposed budgets emphasized infrastructure development.

ETHIOPIA

Ethiopia's mineral industry contributed a modest 1% to the gross national product (GNP), estimated at $4 billion during 1980.[4] Salt, cement, and gold continued to be the most valuable commodities, accounting for approximately 90% or $40 million of the total value of minerals produced in 1980. Cement production accounted for nearly one-half of the mineral industry revenues realized by fiscal yearend 1980.[5] The value of other mineral products grew by approximately 35% over that of the previous fiscal year, owing primarily to increased salt and gold production and high world market prices for precious metals.

A cement plant contract was concluded in September 1980 for the construction of a 1,000-ton-per-day facility at Mugher, in the Menagesha Province. The Ethiopian Building Materials Corp. was constructing the plant and projected a startup date of 1984. The cost of the project was estimated at $96 million with joint financing by Ethiopia (60%) and the German Democratic Republic (40%). Plans were made to minimize cement imports (approximately 1 million tons in 1979) by expanding cement production capacity to 300,000 tons per year. Long-range plans included the construction of a fifth cement plant near Dire Dawa, during which time the three existing, 30-year-old plants would be updated or phased out.

There was a 50% increase in gold production between 1979 and 1980, owing primarily from the increased workings of the Adola alluvial deposits. During the same period, the gold washing pilot plant located at Nejo in western Ethiopia and under the supervision of a United Nations consultant, increased the number of sluiceways from four to nine. The annual output from the pilot plant was approaching 2 kilograms of placer gold by yearend 1980.

Mineral prospecting was conducted for gold, copper, nickel, potash, raw materials for construction and glass industries, petroleum, and other energy resources. Potash prospecting in the Dalol area of Tigre was carried out by the Ralph M. Parsons Co. An attempt was made to construct a deep mine, utilizing the room-and-pillar method. A 92-meter shaft was sunk and drives were made totaling 805 meters. The ore body was described as a mixed potash-salt evaporite with reserves of about 80 million tons. The deposit site had good transportation potential since it was 70 kilometers from the Red Sea port of Mersa Fatima.

Copper prospecting was conducted in the Nejo area of Welega during 1980 and over the past decade in the Debarwa area. The main copper minerals found included bornite and covellite, with minor amounts of chalcopyrite. One of the 1981 proposed projects of the Eastern and Southern African Mineral Resource Development Center (ESAMRDC) included increasing copper exploration and updating a 1974 copper feasibility study. ESAMRDC was also expected to carry out a feasibility study and recom-

mend a method for the exploitation of diatomite resources in the Ethiopian Rift Valley.

Geothermal exploration and deep drilling preparations were made, with financial assistance expected from the European Economic Community and the United Nations. Exploration work was also targeted for the Alufu Volcanic Center in the Rift Valley Lakes area and in the Dallol-Danekil Depression.

Intensive petroleum exploration was conducted in the Ogaden area, southeast Ethiopia, and along the Red Sea coast. A total of 14 deep holes were drilled in the Ogaden and 16 in the Red Sea, with approximately one-half of the total drillings showing oil and/or gas. A most promising hole was drilled at Calub in the Ogaden. The penetrated gas reservoir was estimated to extend 19 kilometers long, 8 kilometers across, and contain 45 billion cubic meters of gas, 75% of which was thought to be recoverable.

Large crude oil imports of approximately 3,310,000 barrels in 1980 consumed roughly one-half of the Nation's export revenues. Coffee and, to a lesser extent, other agricultural products were the principal foreign exchange earners. Ethiopia's overall 1980 trade deficit was approaching $200 million, and the Government budget deficit was projected to exceed $450 million. The budget was expected to be financed 49% by internal borrowing and 51% by external loans and grants.

During 1980, Ethiopia received approximately $3 billion in mostly military aid from the Soviet Union and approximately $220 million from the Western industrialized nations for infrastucture development. The mining sector of the economy continued to be underexploited and hampered by the country's poor political, economic, and investment climate.

Table 2.—Ethiopia: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Copper metal including alloys, scrap	NA	50	--	All to United Kingdom.
Iron and steel metal, scrap	NA	69	--	Italy 54; Belgium-Luxembourg 15.
Zinc metal including alloys, unwrought	NA	100	--	All to Spain.
NONMETALS				
Cement	1,720	--		
Clay products: Refractory including nonclay brick	171	--		
Salt	NA	4,100	--	Congo 2,100; Rwanda 2,000.
Stone, sand and gravel: Dimension stone, worked	2	--		
Other: Slag, ash, and similar waste, not metal-bearing	NA	200	--	Japan 100; United Kingdom 100.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Distillate fuel oil thousand 42-gallon barrels	1,359	1,478	--	Djibouti 933; Arab Republic of Yemen 495.
Liquefied petroleum gas 42-gallon barrels	58	--		
Mineral jelly and wax do	31	--		

NA Not available.

Table 3.—Ethiopia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides	(1)	84	--	West Germany 82; Netherlands 2.
Metal including alloys, semimanufactures	256	390	(1)	Japan 237; Italy 63.
Chromium oxides	40	3	--	West Germany 2; United Kingdom 1.
Cobalt oxides and hydroxides	NA	48	--	Japan 46; Netherlands 2.
Copper:				
Matte kilograms	--	289	NA	Canada 5.
Metal including alloys, semimanufactures	87	130	--	Japan 53; China, mainland 26; West Germany 23.
Gold metal including alloys, unwrought troy ounces	--	96	96	
Iron and steel metal:				
Scrap	429	353	NA	Kenya 104; Djibouti 76.
Pig iron including cast iron	11	35	--	All from United Kingdom.
Sponge iron, powder, shot kilograms	--	500	--	Sweden 400; Netherlands 100.
Ferroalloys: Ferromanganese	2	91	--	Japan 55; Belgium-Luxembourg 36.
Steel, primary forms	8,381	8,724	NA	West Germany 4,714; Poland 2,014; Japan 1,321.
Semimanufactures:				
Bars, rods, angles, shapes, sections	3,341	4,907	--	West Germany 2,669; Italy 1,170; Japan 202.
Universals, plates, sheets	41,491	26,076	NA	Japan 21,623; West Germany 3,403.
Hoop and strip	420	423	--	Italy 256; East Germany 76; Japan 27.
Rails and accessories	2	18	NA	France 12; Italy 1.
Wire	623	380	--	Japan 143; Romania 100; United Kingdom 83.
Tubes, pipes, fittings	2,875	2,171	(1)	India 802; Japan 638; West Germany 189.
Castings and forgings, rough	--	1	--	All from Italy.
Lead:				
Oxides	7	50	--	Sweden 40; West Germany 10.
Metal including alloys:				
Scrap	62	183	--	NA.
Semimanufactures	46	8	--	Belgium-Luxembourg 6; India 1.
Manganese oxides	156	713	(1)	West Germany 314; United Kingdom 215; Israel 90.
Nickel metal including alloys, semimanufactures	3	8	--	Italy 6; United Kingdom 2.
Tin metal including alloys, unwrought and semimanufactures	295	49	--	Japan 46; Netherlands 2; West Germany 1.
Titanium oxides	NA	111	--	United Kingdom 110; East Germany 1.
Zinc:				
Oxides and peroxides	136	163	--	West Germany 81; United Kingdom 57; Japan 25.
Metal including alloys:				
Scrap	856	790	--	West Germany 419; Finland 191; Tanzania 170.
Unwrought	779	831	--	Finland 352; Congo 249; Japan 173.
Semimanufactures	1	150	--	Mainly from Belgium-Luxembourg.
Other:				
Alkali, alkaline-earth, rare-earth metals kilograms	--	1	--	All from Netherlands.
Metalloids	50	--		
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc. kilograms	--	210	--	Italy 200; Switzerland 10.
Grinding and polishing wheels and stones	468	227	3	Denmark 217; Italy 5.
Asbestos, crude	503	326	--	Botswana 300; Italy 26.
Barite and witherite	5	--		
Cement	4	21	--	Kenya 10; Djibouti 8.
Chalk	50	50	--	Mainly from United Kingdom.
Clays and clay products:				
Crude clays	17	316	--	West Germany 203; United Kingdom 40; Japan 33.
Products:				
Refractory including nonclay brick	660	588	--	West Germany 356; United Kingdom 89; Italy 75.
Nonrefractory	580	159	(1)	West Germany 60; Spain 58; Taiwan 25.

See footnotes at end of table.

Table 3.—Ethiopia: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Diamond: Gem, not set or strung value, thousands	$3	--		
Diatomite and other infusorial earth	--	2	--	All from Netherlands.
Fertilizer materials:				
Manufactured:				
Nitrogenous	20,116	13,903	--	Bulgaria 3,978; Netherlands 2,990; Republic of Korea 910.
Phosphatic	1,469	87,788	66,446	Republic of Korea 21,269; West Germany 72.
Potassic	--	120	--	All from France.
Other including mixed	826	27,241	22,599	Republic of Korea 4,591; Netherlands 50.
Ammonia	56	28	--	West Germany 16; Italy 11; United Kingdom 1.
Graphite, natural	1	1	--	All from Italy.
Lime	369	10	--	All from United Kingdom.
Magnesite	--	44	--	Mainly from Japan.
Mica, worked kilograms	NA	5	--	All from Kenya.
Pigments, mineral: Processed iron oxides	NA	25	--	West Germany 13; Spain 12.
Salt	866	55	--	United Kingdom 30; Kenya 14.
Sodium and potassium compounds, n.e.s.:				
Caustic potash	--	80	--	West Germany 60; Spain 20.
Caustic soda	3,149	2,717	--	Italy 1,008; Netherlands 913; United Kingdom 380.
Soda ash	916	195	--	United Kingdom 140; West Germany 45; Italy 10.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked kilograms	5	10	--	All from West Germany.
Worked	1	--		
Dolomite, chiefly refractory grade	51	58	--	All from Italy.
Gravel and crushed rock	--	10	--	All from United Kingdom.
Sand excluding metal-bearing	2	4	4	
Sulfur:				
Elemental, colloidal	1,325	761	9	West Germany 738; United Kingdom 9; Belgium-Luxembourg 5.
Sulfuric acid, oleum	381	820	--	Israel 504; United Kingdom 149; Italy 73.
Talc, steatite, soapstone, pyrophyllite	3	--		
Other:				
Oxides, hydroxides, peroxides of strontium, magnesium, barium	21	108	--	All from West Germany.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	629	88	1	Belgium-Luxembourg 40; Israel 23; Japan 16.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural kilograms	--	3,575	--	West Germany 3,000; United Kingdom 475; Japan 100.
Carbon black	840	699	146	Japan 233; West Germany 207; Israel 112.
Coal, all grades including briquets	86	13	NA	NA.
Coke and semicoke	--	54	NA	NA.
Hydrogen, helium, rare gases	5	5	--	Mainly from West Germany.
Petroleum and refinery products:				
Crude and partly refined 42-gallon barrels	3,745,522	4,394	--	Kuwait 4,025; U.S.S.R. 369.
Refinery products:				
Gasoline do	56,908	98,812	20,528	Arab Republic of Yemen 26,588; U.S.S.R. 15,886.
Kerosine and jet fuel do	63,442	88,180	1,844	Bahrain 40,083; Saudi Arabia 16,508; France 16,376.
Distillate fuel oil do	152,751	215,736	13,331	Bahrain 93,086; Arab Republic of Yemen 23,902; U.S.S.R. 22,343.
Residual fuel oil do	693	579	--	Italy 433; West Germany 120.
Lubricants do	22,372	64,519	574	United Kingdom 21,784; Italy 17,829.
Mineral jelly and wax do	8,106	15,425	(1)	China, mainland 8,004; Romania 3,187; U.S.S.R. 1,574.
Bituminous mixtures do	661	609	518	United Kingdom 91.
Liquefied petroleum gas do	58	23	--	France 11; West Germany 11.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	20	88	74	United Kingdom 13; Italy 1.

NA Not available.
[1]Less than 1/2 unit.

LESOTHO

The Kingdom of Lesotho, one of the world's least developed countries, continued to be heavily dependent on the remittances of Lesotho workers in South African gold and coal mines. Earnings from abroad comprised 41%, and foreign assistance constituted approximately 30% of the 1980 GNP. The value of mineral production, primarily from diamonds, was approximately 6% of the GNP, estimated at $544 million during 1980.[6] Stone, sand and gravel, and bricks continued to be produced on a small scale.

De Beers Consolidated Mines Ltd. (South Africa) produced approximately 51% of Lesotho's diamonds at the Letseng-la-terai Mine. The number of carats recovered by the De Beers operation increased by 15%, and the volume of rock undergoing treatment increased 12% between 1979 and 1980. The grade fell from 3.09 to 2.82 carats per ton, but there was an increase in the average diamond size. The plant throughput was near capacity at 150,000 tons per month, and roughly 13% of the production was hand sorted. The ore reserves were estimated at 9 million tons between the main and satellite pipes, and the mine life was projected to be about 8 years.

The Government was considering the establishment of another diamond pipe mine at Kao, just west of the Letseng-la-terai Mine. The Kao pipe was being worked by Lesotho smallworkers. (Smallworker is a term used to describe a limited number of independent miners, working individually and/or in small groups. This number differs in various countries.) The Lesotho Government received a 10% diamond export levy (equivalent to approximately $2.5 million) and owned 25% of the equity in the De Beers mining operation during 1980.

A United Nations team searched Lesotho's Maluti Mountains for uranium. Traces of uranium were found and samples were sent to the capital, Maseru, for laboratory analyses. The final report on the uranium finds and confirmed deposits were being withheld.

Lesotho's large and growing trade deficit, primarily with the Republic of South Africa, was approaching $350 million by year-end 1980. External aid was projected to total $140 million for fiscal year 1981-82. The bulk of Lesotho's new 5-year plan (1980-85) was expected to be financed by the following major aid donors: The United Kingdom, the Republic of South Africa, the United Nations, the Commonwealth Development Bank, and the African Development Bank. The 1981-82 budget emphasized infrastructure development. The Federal Republic of Germany and the Abu Dhabi Fund for Arab Economic Development were expected to help finance the construction of a new airport project.

MALAWI

Malawi's mineral industry continued to be confined to cement and industrial minerals production. Large-scale exploitation of limestone resources; small-scale mining of clays, stone, sand and gravel; and smallworker lime and gold prospecting were the major activities in 1980. Exploration and initial analyses were conducted for known uranium, coal, phosphate, strontianite-monazite, vermiculite, and glass sand deposits. The Malawi Geological Survey conducted explorations for coal and industrial minerals. Private sector exploration for uranium was halted temporarily during the year, pending the enactment of more favorable mining legislation early in 1981.

Portland Cement Co. (Malawi) Ltd. reported a 31% decline in 1980 cement production from that of the previous year, owing primarily to mill breakdowns. A new mill was installed late in 1980 and production was expected to resume to normal levels early in 1981. A feasibility study for a second cement plant near Kasungu was undertaken by Cementia Engineering Consulting Ltd. (Switzerland). Press Holdings Ltd. was awarded the contract for implementing the cement project.

The agricultural sector comprised approximately 40% of the GDP estimated at $700 million in constant 1973 prices, 90% of the export earnings, and 50% of the total employment in 1980. The growth rate of the economy decreased 0.6% in terms of real GDP between 1979 and 1980. This was attributed to the declining growth in agricultural production and depressed international prices for tobacco and tea, the country's leading exports.

The 1980 balance-of-payments deficit

represented by net reserve figures worsened in 1980 to approximately $55 million. The increased budget deficit, increased oil import bills, and the necessary expansion of debt servicing were all contributing factors. The large 1980-81 development budget, financed primarily with foreign loans, targeted approximately 50% of the expenditures for transportation, agriculture, and education. Malawi's trade deficit, primarily with the United Kingdom, the Republic of South Africa, and other Western Nations was estimated to exceed $80 million by yearend 1979. International assistance agreements concluded in 1980 included the International Monetary Fund (IMF) 2-year, $65 million balance of payments assistance; World Bank 1-year, $30 million structural readjustment loan; and European Economic Community 5-year, $120 million loan.

Table 4.—Malawi: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought ---------- kilograms	--	671	NA	NA.
Wrought ----------	12	14	NA	NA.
Copper metal including alloys:				
Waste and scrap ----------	75	52	--	All to Republic of South Africa.
Wire ---------- kilograms	218	--		
Gold, bullion ---------- troy ounces	--	32	--	All to Switzerland.
Iron and steel metal:				
Waste and scrap ----------	245	600	--	All to Japan.
Semimanufactures:				
Bars and rods ----------	--	41	NA	NA.
Angles, shapes, sections ----------	4	5	NA	NA.
Universals, plates, sheets ----------	58	429	NA	Zambia 68.
Hoop and strip ----------	49	--		
Rails and accessories ----------	359	108	NA	Zambia 91.
Wire ----------	604	133	--	All to Zambia.
Tubes, pipes, fittings ----------	39	49	NA	NA.
Lead metal including alloys: Waste and scrap	--	208	NA	NA.
Platinum-group metals including alloys:				
Unwrought ---------- troy ounces	29	--		
NONMETALS				
Abrasives, n.e.s.: Dust and powder of precious and semiprecious stones ---- kilograms	5	2	--	All to Switzerland.
Precious and semiprecious stones, rough, uncut, n.e.s ---------- do	10,124	2,160	NA	NA.
Salt ----------	182	73	NA	NA.
Sodium and potassium compounds, n.e.s ----	--	1	NA	NA.
Stone, sand and gravel: Dimension stone, rough or shaped, n.e.s ----------	47	--		
MINERAL FUELS AND RELATED MATERIALS				
Carbon black ----------	8	--		
Coke and semicoke ----------	37	--		
Petroleum refinery products:				
Aviation fuel ------ 42-gallon barrels	(1)	--		
Other motor fuel ---------- do ----	16	--		
Jet fuel ---------- do ----	5	--		
Lubricating oils ---------- do ----	268	200	NA	NA.
Grease ---------- do ----	6	--		
Petroleum jelly and wax ------ do ----	47	24	NA	NA.

NA Not available.
[1]Less than 1/2 unit.

Table 5.—Malawi: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys: Semimanufactures	236	227	(1)	Japan 61; West Germany 43; Zimbabwe 29.
Copper metal including alloys:				
Waste and scrap	3	--		
Semimanufactures	125	57	(1)	Republic of South Africa 29; United Kingdom 20.
Gold:				
Bullion, troy ounces	264	210	--	All from United Kingdom.
Metal including alloys, partly wrought, do	190	--		
Iron and steel metal:				
Scrap and waste	--	183	--	All from Republic of South Africa.
Pig iron and similar materials	72	39	--	Mainly from Republic of South Africa.
Powder, grit, shot	19	80	--	All from Republic of South Africa.
Steel, primary forms	46	787	--	Republic of South Africa 327; Japan 266; Canada 194.
Semimanufactures:				
Bars, rods, angles, shapes, sections	6,605	11,420	--	Zimbabwe 4,558; Republic of South Africa 4,432; Italy 1,224.
Universals, plates, sheets	11,367	17,104	5	Republic of South Africa 8,548; Japan 6,522; Zimbabwe 1,454.
Hoop and strip	69	123	--	Republic of South Africa 60; Japan 59.
Rails and accessories	2,043	7,625	53	Canada 5,934; Republic of South Africa 1,598.
Wire	2,371	2,439	20	Republic of South Africa 1,512; Zimbabwe 820; United Kingdom 49.
Tubes, pipes, fittings	2,970	6,364	5	Republic of South Africa 3,543; Japan 873; Canada 478.
Lead metal including alloys:				
Unwrought, kilograms	NA	204	--	Republic of South Africa 154; United Kingdom 50.
Waste and scrap, do	NA	136	--	All from Republic of South Africa.
Foil, powder, flakes, do	125	244	--	Do.
Semimanufactures, do	5,800	7,785	--	Republic of South Africa 7,547; United Kingdom 237.
Nickel metal including alloys:				
Matte, do	NA	20,216	--	All from Republic of South Africa.
Semimanufactures, do	41	121	4	West Germany 70; Canada 42.
Platinum-group metals:				
Ores and concentrates	NA	60	--	All from Republic of South Africa.
Metal including alloys, unwrought and partly wrought, kilograms	18	NA	NA	NA.
Silver metal including alloys, unwrought or partly wrought, grams	5,216	5	--	All from Republic of South Africa.
Tin metal including alloys:				
Unwrought	(1)	36	--	Republic of South Africa 35; United Kingdom 1.
Waste and scrap	(1)	364	--	Mainly from Republic of South Africa.
Semimanufactures	189	36	--	Do.
Zinc metal including alloys:				
Unwrought	24	48	--	All from Republic of South Africa.
Waste and scrap, kilograms	2	--		
Semimanufactures	(1)	17	--	Japan 11; Republic of South Africa 5.
Other: Ores and concentrates, metallic, n.e.s	1	--		
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	9	29	(1)	Republic of South Africa 12; France 10; United Kingdom 5.
Cement	159	10,223	--	Zambia 10,002; Republic of South Africa 121.
Clays and clay products	975	641	--	Republic of South Africa 599; Israel 23.

See footnotes at end of table.

Table 5.—Malawi: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Diamonds, gem, not set or strung troy ounces	2	NA	NA	NA.
Fertilizer materials, natural:				
Nitrogenous	69,151	93,738	10	Israel 27,976; Republic of South Africa 17,301; United Kingdom 13,519.
Phosphoric	68	7,142	100	Republic of South Africa 7,042.
Potassic	NA	1,550	--	France 550; Netherlands 500; West Germany 300.
Other including mixed	NA	600	--	Netherlands 500; Republic of South Africa 100.
Lime	1,645	2,539	--	Zambia 1,990; Republic of South Africa 491; United Kingdom 58.
Mica, worked kilograms	114	165	--	All from United Kingdom.
Precious and semiprecious stone excluding diamond grams	33	NA	NA	NA.
Salt	11,930	3,434	(1)	Mozambique 2,527; United Kingdom 558.
Stone, sand and gravel:				
Dimension stone, worked or partly worked kilograms	1,580	1,773	--	All from Republic of South Africa.
Marble do	NA	481	--	Republic of South Africa 395; United Kingdom 86.
Other stone, sand and gravel, n.e.s	208	939	--	Italy 840; Republic of South Africa 99.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	671	1,226	--	United Kingdom 492; West Germany 345; Netherlands 217.
Other sodium compounds, n.e.s	1,187	1,857	--	Spain 1,032; United Kingdom 471; Belgium 140.
Sulfur:				
Pyrites	6	3	--	Republic of South Africa 2; United Kingdom 1.
Elemental	11	10	--	Republic of South Africa 7; Zambia 3.
Sulfuric acid	51	82	(1)	Republic of South Africa 58; Zambia 23.
Other:				
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, n.e.s	982	1,837	--	Republic of South Africa 1,558; Mozambique 189.
Pyrophoric alloys kilograms	40,392	744	--	Austria 300; Australia 250; West Germany 150.
Other crude minerals, n.e.s	1,442	594	57	Israel 250; Republic of South Africa 244; United Kingdom 35.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	5,738	8,931	4	Republic of South Africa 6,144; Singapore 2,300.
Carbon black	3	10	--	Republic of South Africa 7; Japan 3.
Coal, all grades including briquets	56,529	55,307	--	Republic of South Africa 25,219; Mozambique 24,621; Swaziland 5,467.
Coke and semicoke	10	555	--	Republic of South Africa 520; Zimbabwe 35.
Petroleum:				
Crude and partly refined 42-gallon barrels	NA	65	--	All from West Germany.
Refinery products:				
Gasoline, motor do	308,217	347,957	(1)	Republic of South Africa 334,833; Iran 13,117.
Gasoline, aviation do	4,060	5,193	(1)	Republic of South Africa 5,161; Netherlands 32.
Jet fuel do	97,420	101,338	1	Republic of South Africa 101,323; United Kingdom 14.
Kerosine and white spirit do	1,146	1,469	--	Republic of South Africa 1,444.
Distillate fuel oil do	471,139	522,326	--	Republic of South Africa 489,594; Iran 31,711.
Residual fuel oil do	22,075	26,303	--	All from Republic of South Africa.

See footnotes at end of table.

Table 5.—Malawi: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Lubricating oils including greases 42-gallon barrels	33,348	38,027	276	Republic of South Africa 37,475.
Paraffin oils ——do——	68,470	73,523	--	Republic of South Africa 72,072; Iran 976.
Liquefied petroleum gas ——do——	3,919	3,459	--	Zambia 2,838; Republic of South Africa 621.
Mineral jelly and wax ——do——	4,397	2,466	592	West Germany 640; Republic of South Africa 605.
Petroleum coke ——do——	110	6,644	16	Republic of South Africa 6,479; United Kingdom 148.
Unspecified ——do——	70	544	--	Republic of South Africa 526; United Kingdom 8.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	21	17	3	United Kingdom 11; Republic of South Africa 3.

NA Not available.
[1]Less than 1/2 unit.

MAURITIUS

Mauritius, an island of volcanic origin located approximately 800 kilometers east of Madagascar in the Indian Ocean, was severely affected by four cyclones in early 1980. The country was the world's 10th largest sugar producer, and sugar contributed approximately 35% of the GDP, 75% of exports, and 30% of employment by yearend 1979. Adverse weather conditions resulted in flooding and a 35% decline in 1980 sugar production. Floods were also responsible for inhibiting the small-scale mineral production and transportation of the island's mineral resources—stone (basalt), salt, and lime.

The most significant development in the Mauritian economy was the October 1979 23% devaluation of the rupee against the IMF Special Drawing Rights. The net effect of the devaluation and other restrictive monetary and fiscal policies imposed by the IMF was to raise domestic inflation to approximately 40% at yearend 1979 and make Mauritian exports more competitive in international markets. The IMF loan of $980,000 and $1.8 million worth of aid from the Republic of South Africa were expected to help the growing balance-of-payments deficit, estimated at $126 million by yearend 1980.

REPUBLIC OF COMOROS

The Comoros island archipelago was classified as a low-income developing country with an estimated GDP of $50 million. There were no known exploitable mineral deposits in 1980, and only small amounts of sand and gravel were mined for local consumption.

The Republic of Comoros became a member of the ESAMRDC in 1977. The first ESAMRDC work program was outlined in 1980 and included among its proposed projects the evaluation of geothermal energy resources in the Comoros. The United Nations Development Program (UNDP) recently completed a geothermal project, but no information was available by yearend 1980.

The growing balance-of-trade and budget deficits were supported primarily through unilateral aid programs (France, Kuwait, and Madagascar). Most of the assistance proposed for 1980-81 focused on improving transportation infrastructure. Numerous Arab Regional Banks and Development Funds have indicated an interest in offering financial assistance.

REUNION

The Department of Reunion is a French island located approximately 640 kilometers east of Madagascar in the Indian Ocean. Reunion's predominantly agricultural economy experienced a slowdown in 1979-80 owing primarily to a decline in sugar production. Construction and public works also experienced difficulties, which resulted in the closing of a number of important companies. Unemployment was estimated at 31.5%, and approximately 50% of the population was under 25 years of age. The mineral industry continued to be confined to the 200,000-ton-per-year clinker cement grinding plant at Saint Denis. Production and consumption data were unavailable for cement and other domestically consumed construction materials.

Reunion's trade deficit, represented by the value of imports divided by the value of exports, was projected to reach 20% by yearend 1980. Reunion imports 80% of what the island consumes; however, unlike most nonoil-producing developing countries, the share of fuel imports have been minimized. The island's hydroelectric power potential was nearly 500 million kilowatt-hours by yearend 1980. The Rivière de l'Est powerplant, located at Saint Rose, was completed and commissioned during the year. The first stage with 44,000 kilowatts of installed power was expected to yield an average annual production of 380 million kilowatt-hours, slightly exceeding 1980 energy consumption requirements.

RWANDA

Rwanda's mineral industry continued to be a small yet significant contributor to the GDP, estimated at $1.1 billion in current 1980 prices.[7] During 1980, the value of mineral production was second only to coffee in terms of GDP. Mineral exports provided approximately 25% of the 1980 foreign exchange earnings and when combined with coffee, they comprised roughly two-thirds of the Nation's total exports. Rwanda produced approximately 1.1% of the world's output of tin concentrates and also produced cassiterite, beryllium, columbium-tantalum, wolframite, and alluvial gold. The mineral industry started showing signs of recovery in 1980, after the industry's downturn and stagnation during the late 1970's. Cassiterite and tungsten production were reported to have moderately increased, beryl and columbite-tantalite production increased by over 25%, and the output of gold increased a hundredfold between 1979 and 1980.

Société Minière du Rwanda (Somirwa) continued to operate the major mines, employing between 8,000 and 9,000 workers and accounting for approximately 70% of total mineral production. The remainder of the output was mined by the tens of thousands of tributors. These individuals, and/or small cooperatives, exploited the small valuable mineral pockets scattered throughout the country (mostly gold and cassiterite). Somirwa had a 5-year development budget of $11.8 million, which was depleted by only slightly over 10% by yearend 1980. Strong financial support by the Government and foreign investment incentives, including tax holidays and duty-free import privileges for new industrial operations (5-year maximum), have facilitated the growth of the mineral sector of the economy.

Detailed followup studies of UNDP's geophysical and geochemical surveys were underway. The French Bureau des Recherches Géologiques et Minières, partly funded through UNDP, was concentrating investigations on 2,100 square kilometers in the central northern part of the country. Evaluations of the Mushunga limestone deposits were completed in 1980. Discussions for the construction of a 50,000- to 100,000-ton-per-year cement facility adjacent to the deposits in Cyangunzu were initiated. Construction of a 12-megawatt power station near Lake Luhonde commenced after the Geological Survey completed the evaluation of the country's extensive peat deposits.

The growing trade deficit of approximately $57.4 million in 1980 was a product of supply shortages, declining exports, and increasing oil import bills. The balance-of-payments surplus reported in 1979 was attributed to international financial assistance primarily through the 5th European Development Fund (Lome II) and aid programs with the Federal Republic of Germany, France, Japan, and several Arab Nations.

SEYCHELLES

The only mineral commodity produced and exported in Seychelles during 1980 continued to be guano. The mineral industry contributed less than 1% to the 1980 GDP estimated at less than $100 million.[8] The value and production of guano declined by 27% and 35%, respectively, between 1979 and 1980. Discussions were underway between the Seychelles Government and an Italian firm to exploit the islands' valuable 600-million-year-old granite resources.

The Assab refinery significantly contributed to the availability of domestic oil products and exported nearly 75% (1.4 million barrels) of the black naphtha produced in 1980. Oil explorations by AMOCO Seychelles Petroleum Co. continued throughout 1979-80. By yearend 1979, AMOCO in participation with other foreign oil companies possessed the rights for 24 offshore blocks. The partners withdrew and AMOCO expanded their exploration area to 26 blocks. The first test well drilled in 1980, was Owen Bank No. 1, located offshore Mahe, Seychelles' largest island. The cost was estimated to exceed $14 million. Plans were made to conduct future drillings on the Reith Bank, closer to the Mahe island.

Seychelles is strategically located off East Africa in the middle of the Indian Ocean, and the islands have excellent harbor facilities. Tourism and international assistance have largely contributed to the record balance-of-payments surplus of approximately $7.3 million by yearend 1980. Discussions were underway with the World Bank to lend financial assistance to the Seychelles East Coast Reclamation Project. Nearly 21% of the country's 1980-84 development budget was allocated for this comprehensive road, harbor, and port facility improvement plan. A contract was signed in 1980 with Zanen Verstoep Co. (Netherlands) to dredge and initiate reclamation work at Port Victoria and Mahe Quay.

SOMALIA

Mineral production in the Somali Democratic Republic was confined to small-scale mining of tin (cassiterite ore), sea salt, stone, limestone, and meerschaum (sepiolite). The mineral industry continued to be a very small contributor to the Nation's economy. The construction of a 200,000-ton-per-day cement facility in Berbera was near completion, and discussions were underway to construct a fertilizer plant by yearend 1980. Exploration continued on the prospective uranium, coal, and lead deposits in the northern part of the country.

The Somali Arab Mining Co. (a joint venture with the Pan-Arab Mining Co.) was investigating the economic feasibility of uranium mining at Galgudad. Other uranium prospecting continued, including a radiometric survey of the Nagal area. In addition, an 85,000-square-kilometer area located between Kolkodo and Modok was reported to contain commercial uranium deposits. Pilot-scale tests were being planned for several sites, and the Arab Community Fund was expected to finance a uranium processing plant. Somalia's Geological Survey continued the search for coal in 1980.

Oil explorations were intensified, since petroleum imports accounted for $43 million in 1980. During June 1980, the International Development Administration (IDA) granted $6 million in credit for a Petroleum Exploration Promotion Project. Agreements were negotiated between Somalia and Cities Service Co. (United States), Texaco Oil Co. (United States and Federal Republic of Germany subsidiaries), and Atlantic Richfield Oil Co. (United States) to explore nearly 750,000 square kilometers throughout Somalia.

Somalia's overall energy future looked promising in 1980, despite the dependence on Iraqi crude oil imports. Production at the recently completed Magadiscio oil refinery was brought close to capacity of 10,000 barrels per day. Approximately 1.8 million barrels of crude oil and oil products were imported primarily from Iraq and later in the year from the People's Democratic Republic of Yemen. The completion of the Gezia power station increased Somalia's electric power generating capacity by nearly 92% early in 1980.

Somalia's balance-of-payments deficit continued to worsen in 1980 owing primarily to the influx of refugees and the extended drought. Approximately 30% of the GNP, estimated at $407 million in 1980, was comprised of livestock and agricultural

products. International and bilateral assistance continued to keep the country afloat in 1980, despite the acute lack of foreign exchange, near fuel crisis and exorbitant rates of domestic inflation. In August 1980, the United States agreed to give $40 million in military aid and $5 million in economic assistance to Somalia over a 2-year period in return for access to the port and airbase facilities at Berbera. Approximately $132 million was provided for refugee and related development assistance in 1980, primarily through the United Nations and other Western and Arab countries' bilateral assistance programs.[9]

SWAZILAND

The value of Swaziland's mineral industry continued to decline, contributing less than 15% to the 1980 GDP, estimated at $385 million.[10] The percent change in mineral revenues between (1979-1980) was negative for nearly all mineral commodities including iron ore, asbestos, and quarried stone except for anthracite coal. The decline in revenues was attributed primarily to the cessation of the Ngwenya iron ore exports in August 1980, diminished production and sales from the Havelock asbestos mine, and decreased demand for quarry stone. The chrysolite asbestos mine at Bulembu, northwest Swaziland, became the Nation's leading mineral export in 1980, despite the mining of lower grades (larger proportion of short asbestos fibers over higher priced long fibers) encountered at increasing depths.

By yearend 1980, coal appeared to be the mineral commodity with the most promising future. The majority of the identified reserves of approximately 200 million tons were considered to be chiefly of the type with low sulfur and high energy content. Swaziland Coal Corp.'s only existing mine, Mpaka Mine, exported roughly two-thirds of its production and expansion plans were being considered. In addition, two new coal mines in eastern Swaziland were proposed. Several foreign firms indicated an interest in prospecting for tin, gold, diamond, and kaolin as well as coal. The regional geochemical sampling program was completed, and a report was published indicating potential mineral occurrences of copper, lead, zinc, manganese, cobalt, nickel, molybdenum, and tin.

The Swaziland Geological Survey and Mines Department continued to investigate coal deposits in the Lowveld and encouraged joint venture participation with foreign firms. The Japanese and Swaziland Governments were negotiating respective financial and supervisory roles for the deep coal exploration and drilling project at Libhuku, within the Lowveld. Shell Coal Swaziland (Pty.) Ltd. submitted a mining rights application, after completing the shaft and underground mine development work at Mhlume. Mining rights were granted to Swaziland Coal Corp. for a promising 760 hectares in the Lowveld. A new Special Exclusive Prospecting License for a 115,000-hectare area in the southern portion of the Lowveld was transferred from Inter-Coal Trading A.G. Ltd. to Inter-Coal Mining and Trading Ltd. (Switzerland).

Evaluation of residual tin deposits with assistance from the Federal Republic of Germany continued in the Makwanekop-Motshane and Sinceni areas. A small-scale pilot treatment plant was constructed and operated at Sinceni during 1980.

Swaziland's balance-of-payments continued to worsen in 1980 owing primarily to slow growth in export volume, rapid rise in import expenditures, an increasing Government budget deficit (covered by foreign financing), and a gradual decline in worker remittances from South African mines. The economy was expected to be stimulated in part by increased capital spending in the public sector, expansion of the country's hydroelectric power systems, and completion of the North-South rail line. A 20-megawatt hydroelectric power station with a 90-million-kilowatt-hour annual capacity was proposed in the Sipocosini area. The Swaziland Railroad Co. was awaiting Government approval for the construction of the northern railroad link to Komatipoort. The railroad was operating at a loss because of the decline in iron ore shipments, but the completed rail system was expected to recover from mineral and agricultural product traffic from the South African Transvaal and from anticipated Swaziland coal shipments from the Tshaneni area.

UGANDA

Uganda's mineral industry and overall economy stagnated during 1979-1980. Despite promises made by the transition and new Government to rehabilitate the mining sector, tungsten, cassiterite, columbite-tantalite, phosphate, gold, cement, and asbestos production virtually ceased. The three previously operating tungsten mines at Bjorda, Luhizha, and Buyaga; the Buhanga tin mine; gold mining in the Mushanga, Busia, and Kigezi areas; the Toros cement plant; and the Universal Asbestos and Plastics Co. manufacturing plant all suffered from severe shortages of machinery, equipment, and replacement parts. These factors, combined with transportation difficulties through Kenya's Port of Mombasa and a lack of vehicles and/or foreign exchange for private road haulage, contributed to the sharp decline in mineral production and trade during the year. In December 1980, the new Government granted full tax holidays for industrial enterprises (over defined periods of time) to induce investment in mineral and other industrial activities.

Investigations to rehabilitate the Kilembe copper-cobalt mine continued throughout the year. The mine's cobaltiferous tailings that have accumulated during the mine life (1956-77) were estimated to contain between 1.41% and 1.44% cobalt, 38% iron, and minor amounts of gold and silver.[11] The Ugandan Government, which owns 100% of the Kilembe Mine, invited tenders to contract for both the rehabilitation of the mine, concentrator, and smelter facilities and the establishment of a cobalt project, including downstream recovery of sulfuric acid.

In December 1980, a memorandum of agreement was signed with Falconbridge Nickel Mines Ltd. (Canada) to undertake two feasiblity studies addressing the mine reopening and cobalt concentrate processing and marketing. The contract specified that mineral production would belong to the Ugandan Government and Falconbridge Nickel Ltd. would receive the exploitation rights only. No other details were disclosed by yearend 1980.

The Lake Katwe Salt Co. opened a 150-ton-per-day salt manufacturing plant in June 1980. The main contractor for the facility was a West German firm, and financing was provided by the Federal Republic of Germany, the East African Development Bank, the African Development Bank, and the Ugandan Development Corp. Anticipated annual production included 45,000 tons of common salt, 15,000 tons of potassium chloride, 500 tons of elemental sulfur, and other chemicals. The economic viability of the salt pan was estimated at 20 years.

Uganda's balance-of-payments deficit was estimated at $200 million by yearend 1980.[12] IDA financed $8 million worth of technical assistance for the Ugandan Government to prepare rehabilitation and development projects. The African Development Bank and Iraq granted approximately $18 million primarily for ranch restorations and other development projects. Discussions were underway with the various United Nations organizations and the European Common Market for additional assistance.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Burundi francs (FBu) to U.S. dollars at a rate of FBu90.0=US$1.00.

[3]The IGEBU was promulgated by the Burundi Government in Decree No. 100/146, Sept. 30, 1980.

[4]Where necessary, values have been converted from Ethiopian birr (B) to U.S. dollars at a rate of B2.0855=US$1.00.

[5]Ethiopia's fiscal year was from July 7, 1979 through July 6, 1980.

[6]Where necessary, values have been converted from Lesotho loti (L) to U.S. dollars at a rate of L0.786=US$1.00.

[7]Where necessary, values have been converted from Rwandan francs (RF) to U.S. dollars at a rate of RF91.48=US$1.00.

[8]Where necessary, values have been converted from Seychelles rupees (SR) to U.S. dollars at a rate of SR5.89=US$1.00.

[9]Official planning figure used by the United Nations.

[10]Where necessary, values have been converted from Swaziland lilangeni (L) to U.S. dollars at a rate of L1.00=US$1.30.

[11]Mining Magazine. Rehabilitation of the Kilembe Mine, Uganda. V. 143, No. 4, October 1980, p. 281.

[12]Where necessary, values have been converted from Ugandan shillings (USh) to U.S. dollars at a rate of USh7.42=US$1.00.

The Mineral Industry of Other West African Countries

By Joseph B. Huvos[1]

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BENIN

Said to be one of the world's most underdeveloped countries, Benin had a gross national product (GNP) estimated at $1 billion in 1980.[2] Contribution of the mineral industry such as cement and limestone to the GNP was negligible, but exploration of mineral potential continued.

Minerals.—The United Nations Development Program (UNDP) conducted an investigation of three deposits from 1977 to 1980: Phosphates (Mekrou), gold (Perma), and chromite (Buem). A phosphate rock deposit containing about 4.5 million tons recoverable by opencast techniques was discovered. It was not known if the gold and chromite deposits were recoverable economically. Iron ore deposits of some 230 million tons near Loumbo-Loumbo are at present not exploitable because of lack of infrastructure in the northern part of the country. Geologic mapping with British and French assistance was also pursued in 1980.

Electric Power.—Power was mostly imported from Togo and Ghana. However, it was decided to expand the capacity of the Cotonou thermal powerplant by 15 megawatts. The Government also decided to call for bids for a dam project with a hydroelectric powerplant of 60 megawatts on the Mono River near Nangbetou.

Kaolin.—The Ceramic Experience, of Chester, W. Va. (United States), sponsored by the United Nations Revolving Fund, made a series of testpits at an unspecified location, indicating about 50,000 tons of kaolin in an area of 10 acres, with further indications over another 60 acres.

Petroleum.—The Norwegian Government approved a $104 million loan to finance development of the small offshore Seme Oilfield. The field is being developed by Saga Petroleum AS of Norway; Kvaerner Engineering, also from Norway, manages the project. Reserves were only 3 million tons, and production was to start in 1982 at the rate of 250,000 tons per year. In the meantime, Mechanical and Industrial Technicians (United States) signed a letter of intent to build a reported $900 million oil refinery with a capacity of 8 million tons per year in partnership with the Government.

Table 1.—Other countries of West Africa: Production of mineral commodities[1]

Country[2] and commodity[3]	1976	1977	1978	1979	1980[p]
BENIN					
Cement, hydraulic[4] ____ metric tons	190,000	200,000	200,000	151,000	160,000
Salt, marine[e] ____ do.	150	300	300	350	400
Stone: Gravel[e] ____ do.	16,000	18,000	20,000	21,000	22,000
CAPE VERDE ISLANDS					
Cement, hydraulic[e] ____ do.	4,000	4,000	15,000	15,000	15,000
Pumice and related volcanic materials ____ do.	15,000	15,000	15,000	16,000	16,000
GUINEA					
Aluminum:					
Bauxite, gross weight thousand metric tons	10,848	10,841	10,456	13,700	13,780
Alumina ____ do.	560	562	610	660	708
Diamond:					
Gem[e] ____ thousand carats	25	25	25	27	12
Industrial[e] ____ do.	55	55	55	58	26
Total ____ do.	[e]80	[e]80	[e]80	[e]85	38
IVORY COAST					
Diamond:					
Gem[e] ____ thousand carats	22	7	--	5	10
Industrial[e] ____ do.	38	11	10	32	65
Total ____ do.	60	18	10	37	75
Petroleum:					
Crude oil ____ thousand 42-gallon barrels	--	--	--	--	90
Refinery products:					
Gasoline ____ do.	2,193	2,166	2,210	[e]2,200	2,091
Kerosine and jet fuel ____ do.	1,101	1,388	1,117	[e]1,100	1,248
Distillate fuel oil ____ do.	3,595	3,235	3,678	[e]3,600	2,768
Residual fuel oil ____ do.	4,709	4,482	4,344	[e]4,300	4,995
Liquefied petroleum gas ____ do.	110	[e]122	182	[e]180	93
Refinery fuel and losses ____ do.	490	[e]451	521	[e]500	482
Total ____ do.	12,198	[e]11,844	12,052	[e]11,880	11,677
MALI					
Cement, hydraulic ____ metric tons	[e]50,000	35,174	34,400	26,758	20,000
Gold, mine output, metal content ____ troy ounces	900	[e]932	965	[e]1,000	[e]1,500
Salt[e] ____ metric tons	4,500	4,500	4,500	4,500	4,500
Stone:					
Granite ____ square meters	NA	8,088	6,000	415	--
Marble ____ do.	NA	217	400	400	500
Limestone ____ metric tons	NA	394	495	500	4,600
NIGER					
Cement, hydraulic ____ do.	36,240	40,000	[e]40,000	38,000	[e]38,000
Gypsum ____ do.	[e]2,588	3,000	2,720	2,720	[e]2,720
Salt[e] ____ do.	1,000	1,000	900	900	3,000
Stone, sand and gravel:					
Limestone, not further described ____ do.	56,456	60,000	NA	NA	NA
Gravel ____ cubic meters	179,268	[e]180,000	[e]180,000	180,000	180,000
Sand ____ do.	[e]5,937	[e]6,000	[e]6,000	6,000	6,000
Tin, mine output, metal content ____ metric tons	126	130	125	125	56
Uranium concentrate, U_3O_8 content ____ do.	1,460	1,440	2,060	3,740	4,869
SENEGAL					
Cement, hydraulic ____ do.	386,000	330,000	357,000	380,688	386,234
Clays: Fuller's earth (attapulgite) ____ metric tons	4,627	3,405	6,930	13,000	3,978
Gold ____ troy ounces	--	--	[e]250	--	NA
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels	980	[e]1,038	502	1,141	1,057
Jet fuel and kerosine ____ do.	932	[e]666	616	1,095	1,101
Distillate fuel oil ____ do.	1,144	[e]1,551	2,248	1,319	1,178
Residual fuel oil ____ do.	1,855	[e]2,148	1,883	2,121	1,985
Other ____ do.	43	[e]58	57	102	87
Refinery fuel and losses ____ do.	153	[e]216	[e]256	235	188
Total ____ do.	[r]5,107	[e]5,677	[e]5,562	6,013	5,596
Phosphate rock and related products:					
Crude:					
Aluminum phosphate thousand metric tons	208	275	204	184	224

See footnotes at end of table.

Table 1.—Other countries of West Africa: Production of mineral commodities[1] —Continued

Country[2] and commodity[3]	1976	1977	1978	1979	1980[p]
SENEGAL —Continued					
Phosphate rock and related products —Continued					
Crude —Continued					
Calcium phosphate thousand metric tons	1,591	1,596	1,555	1,651	1,408
Manufactured:					
Aluminum phosphate, dehydrated do	68	69	48	78	132
Other[5] do	6	6	6	10	8
Salt metric tons	141,953	140,000	140,000	140,000	140,000
Stone:					
Basalt cubic meters	168,500	e168,500	100,000	NA	NA
Marble (cipoline) do	250	e250	e150	NA	NA
TOGO					
Clays, for brick production metric tons	4,234	NA	NA	NA	NA
Phosphate rock, beneficiated product thousand metric tons	2,008	2,857	2,827	2,920	2,933
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	--	--	e435	673	e1,490
Kerosine and jet fuel do	--	--	e280	432	e950
Distillate fuel oil do	--	--	915	1,417	e3,130
Residual fuel oil do	--	--	e290	440	e990
Minor products refinery fuel and losses do	--	--	e130	e200	e440
Total do	--	--	e2,050	3,162	e7,000
Salt metric tons	e200	--	650	650	600
Stone:					
Granite do	606	NA	NA	NA	NA
Marble, dimension square meters	1,361	NA	23	NA	NA

eEstimated. pPreliminary. rRevised. NA Not available.

[1]Includes data available through Oct. 12, 1981.

[2]In addition to the countries listed, The Gambia, Guinea-Bissau, and Upper Volta, which are covered in the text of this chapter, presumably produce modest quantities of a variety of crude construction materials (clays, stone, and sand and gravel) and may produce minor amounts of other mineral commodities (most notably gypsum, lime, and salt), but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3]In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (clays, stone, and sand and gravel) presumably are produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[4]Output apparently based entirely on imported clinker.

[5]Products marketed under the trade names "Balifos," "Phospal," and (in 1980 only) "P 125" (the latter described as crushed aluminum phosphate).

CAPE VERDE ISLANDS

Mineral production on the Cape Verde Islands was limited to modest quantities of crude construction materials, such as clays, stone, sand and gravel, and some solar evaporated salt. GNP in 1980 was an estimated $135 million,[3] with minerals contributing negligible amounts.

In 1980 Cape Verde awarded a $118,000 contract to a South African company to build a seawater desalinization plant.

THE GAMBIA

The Gambia consists of the shores of The Gambia River and is surrounded on land by Senegal. In 1980, The Gambia had no mineral production besides unreported quantities of crude building materials. However, there were several tentative mineral projects, as mentioned hereinafter. In 1980, estimated GNP was $200 million.[4] Contribution of minerals to the GNP was negligible.

Energy.—The hydroelectric project on The Gambia River, supported by the African Development Bank, continued and was to be commissioned in 1981. One of the dams is located at Mansa Konko.

Petroleum.—Chevron Overseas Petroleum Company (United States) and Compagnie Française des Pétroles S.A. (Total) completed a 2-month offshore drilling program, but results were not made known. Chevron reportedly intended to retain its exploration and prospecting license in The Gambia.

Titanium.—Recently explored deposits of heavy beach sands south of The Gambia River contain about 5 million tons of zircon, rutile, and ilmenite, and further upstream kaolin has been known, but no plans for industrial exploitation have been published.

GUINEA

In 1980, Guinea's centrally controlled economy, dominated by the mineral sector, leveled off. The GNP was $1.5 billion.[5] The mineral sector accounted for 23% of the GNP and 95% of export earnings, with bauxite remaining the most important mineral. Liberalization of the Guinean economy continued with the publication of a new investment code and the country's fourth development plan (1981-85). In the mineral sector, foreign investors were encouraged by the Government of Guinea in the hope that they would contribute to the development of iron ore, uranium, and gold in the near future, and of petroleum, copper, manganese, and other minerals at a later date.

Bauxite and Alumina.—In 1980, Guinea was the world's second largest producer of bauxite, and its reserves of 6.5 billion tons were the largest in the world.

The country's largest bauxite producer was the Compagnie des Bauxites de Guinée, owned by the Government (49%) in partnership with a consortium composed of the Aluminum Co. of America, the Aluminum Co. of Canada, Martin Marietta, Péchiney, Vereinigte Aluminiumwerke AG, and Montedison. In 1980, the company produced 9 million tons of bauxite for export at the Boké-Sangaredi mining complex located in the northwest, at the terminal of the Kamsar-Sangaredi Railroad line.

The second largest producer was the Office des Bauxites de Kindia, a Government-owned, Soviet built and managed project. In 1980 production was 2.5 million tons. Ninety percent of production was contracted to the Soviet Union and the rest to Eastern Europe. The mine is located at Kindia, on the Conakry-Kankan Railroad line.

The third largest producer of bauxite was the Société d' Économie Mixte Friguia owned by the Government (49%) and Frialco Co. (51%), the latter consisting of Noranda Mines Ltd. (38.5%), Pechiney-Ugine-Kuhlmann (36.5%), British Aluminum Ltd. (10%), and Vereinigte Aluminium Werke AG (5%). Over 2 million tons of bauxite were mined at Fria, at the terminal of the Conakry-Fria Railroad line, and converted at the same location into 660,000 tons of alumina. The alumina plant was being expanded to 700,000 tons of alumina per year at a cost of $33 million.

Besides these existing operations, others were in various stages of planning, involving deposits at Ayékoyé near Boké (northwest) and at Tougoué and nearby Dabola, in central Guinea.

Cement.—A $12 million grinding plant to produce bagged cement from imported clinker was completed but lay idle because of a power shortage.

Diamond.—In 1980, the Bourse Nationale des Diamants, in the name of the Government's Central Bank, held its first auction since the early 1970's, selling 6,000 carats valued at $1 million. This production came from private Guinean operators who were given permits to operate near the rich diamond concession of Beyla in the southeast.

Among a number of diamond mining concessions awarded in recent years were those of Industrial Diamond Co. of the United Kingdom, with an area covering 30,000 square kilometers, and Charles Anthony of the United States, covering 20,000 square kilometers.

Reportedly, diamond reserves in 1980 were estimated at 300 million carats worth $40 to $60 billion.

Gold.—The Société Minière Internationale du Quebec (Somiq) announced plans to develop a gold deposit in Guinea. An exploration program was conducted under lease rights covering a 39,000-square-kilometer area in the northeast of the country. Somiq plans to develop shallow alluvial deposits in the area.

Hydroelectric Power.—The Government, the World Bank, Arab funds, and a number of aluminum companies, including Alusuisse, Péchiney, and Vereinigte Aluminiumwerke AG, met in 1980 to discuss ordering feasibility studies for a 750-megawatt hydroelectric project and a 155,000-ton aluminum smelter worth $2.5 billion, both at Konkouré. It was decided that further studies were necessary to evaluate the effect of the project on the Guinean economy.

Iron Ore.—The Mifergui-Nimba iron ore project in southern Guinea moved closer to realization as its prospective partners, the Government (50%) and unnamed foreign interests (50%), reached an agreement with Liberia on transport charges for the movement of iron ore across Liberia on the existing Liberian-American-Swedish Minerals Co. railway to the Port of Buchanan.

Petroleum.—Société Guinéenne des Hydrocarbures, a joint venture between the Government of Guinea and Union Texas Petroleum (United States), conducted a seismic survey in the northern third of Guinea's territorial waters in the fall of 1980. It was expected that decisions on drilling will

be made on the basis of the surveys when results are available. Negotiations for other offshore concessions were underway. At present, Guinea has no petroleum production.

Uranium.—The Compagnie Générale des Matières Nucléaires (Cogema), a French, Italian, and Japanese joint venture, continued to explore for uranium in the north (above 110° N latitude). Traces of uranium were found there, but it was not yet known if any deposits are of commercial value.

Geosurvey, a geological research company, conducted aerial surveys in the southern part of the country, with results not known. Besides these, the Government asked Romania, the Federal Republic of Germany, Switzerland, and Yugoslavia for technical assistance to conduct ground surveys for radioactive minerals.

GUINEA-BISSAU

In 1980, Guinea-Bissau continued to have major economic problems but was completing an ambitious development plan. GNP was $174 million.[6] There was no mineral industry production, but several mineral projects were in various stages of development.

Aluminum.—The Government was considering a modern aluminum industry using its bauxite resources in the Boe region. This project is in the distant future and depends upon the feasibility of the proposed Corrubal River Dam as an energy source. The UNDP was conducting feasibility studies.

Petroleum.—A potential of 7 to 8 million tons per year has been estimated for the offshore Boe region. However, sensitive territorial water disputes with both of Guinea-Bissau's neighbors, Guinea and Senegal, must be solved before exploitation can begin. The World Bank has offered help in financing exploration on the Continental Shelf.

Phosphate.—The Government, in conjunction with the French Bureau de Récherches Géologiques et Minières (BRGM), was studying phosphate deposits in Cacheu and Oio.

IVORY COAST[7]

The Ivory Coast witnessed its economic growth stagnate at about 1.5% annually—down from more than 9% during the years of the robust coffee and cocoa markets of the mid-1970's. The nation's oil bill climbed to about $450 million in 1980 from $200 million 2 years earlier, and debt services stood at 30% of its entire export earnings.

Mineral exploration efforts of the Ivory Coast state oil company Société Nationale d'Operation Pétrolière de la Côte d'Ivoire (Petroci), Société pour le Développement Minière de la Côte d'Ivoire, and the BRGM of France continued during 1980. These activities included aerial geophysical exploration and work on selected anomalies, which had been identified by these groups in the past several years. Their targets were mostly uranium, copper, lead, zinc, and silver. By the end of 1980 no further details of exploration results had been announced.

Diamond.—The Société Franco-Ivoirienne Tortiya, which operated diamond mines in the Ivory Coast, ceased mining in 1980 because of ore exhaustion. Thus, the only mine operation of any kind in the country came to an end.

Petroleum.—The Ivory Coast became the newest oil-producing nation in West Africa in 1980. During the year, production from the offshore Bélier Field became a reality, while appraising of the Espoir Field, one of the largest offshore fields found in West Africa, continued.

The Bélier Field, owned by Exxon subsidiaries (63.75%), Shell Côte d'Ivoire (21.25%), and Petroci (15%), is located about 20 kilometers southeast of Abidjan. It was put into production in mid-1980; crude oil was moved through a 10-inch pipeline to shore, where, by virtue of another 7-kilometer, 10-inch pipeline, it was delivered to Ste. Ivoirienne de Raffinage, the state-owned refinery. This field produced an average of 10,000 barrels per day late in 1980, but output was expected to rise to 30,000 barrels per day by the mid-1980's.

The Espoir Field, owned by Phillips Petroleum (57.5%), Italian Petroleum Enterprise-National Hydrocarbon Agency (22.5%), Sedco of the Ivory Coast (10%), and Petroci (10%), is located in the Gulf of Guinea 40 kilometers to the southwest of Abidjan, in water depths between 300 and 2,400 feet. During the year, Phillips, as operator, drilled six wells, in which the flow rate averaged 4,000 barrels per day. The find was certain to spur exploration

in deeper waters all along the West African oil province. Oil production from Espoir, expected by the mid-1980's, would enable the country to become not only self-sufficient in oil, but also an exporter by the late 1980's.

Table 2.—Ivory Coast: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	1,164	1,300	NA	Niger 514; Upper Volta 452; Togo 196.
Copper metal including alloys, all forms	708	--		
Iron and steel metal:				
Scrap	19,806	19,031	NA	Italy 11,550; Spain 7,160.
Unwrought and semimanufactures	706	1,649	NA	Mali 538; Togo 101.
Lead:				
Oxides	--	1	NA	NA.
Metal including alloys, all forms	584	817	NA	Italy 418; Hong Kong 90.
Titanium oxides	--	2	NA	NA.
Zinc metal including alloys:				
Scrap	119	5	NA	NA.
Semimanufactures	2	--		
Other: Oxides, hydroxides, peroxides	33	--		
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	(1)	5	NA	NA.
Grinding and polishing wheels and stones	1	1	NA	NA.
Cement	98,546	2,996	NA	Upper Volta 2,844.
Chalk	--	5	NA	NA.
Clays and clay products:				
Crude	13	3	NA	NA.
Products:				
Refractory including nonclay brick	12	4	NA	NA.
Nonrefractory	--	243	NA	Benin 231.
Diamond:				
Gem, not set or strung ---- carats	48,325	NA	NA	NA.
Industrial ---- do	89,830	NA	NA	NA.
Fertilizer materials:				
Crude and manufactured	15,197	289	NA	NA.
Ammonia	--	15	NA	NA.
Gypsum and plasters	2	--		
Lime	76	207	NA	NA.
Pigments, mineral:				
Natural, crude	1	1	NA	NA.
Iron oxides, processed	30	--		
Salt	13	53	NA	NA.
Sodium and potassium compounds, n.e.s.:				
Caustic potash	(1)	--		
Caustic soda	3	54	NA	NA.
Soda ash	NA	10	NA	NA.
Stone, sand and gravel	1	1,071	NA	NA.
Sulfur:				
Elemental, all forms	--	2	NA	NA.
Sulfuric acid, oleum	175	129	NA	NA.
Talc, steatite, soapstone	21	2	NA	NA.
Other, crude	30	13	NA	NA.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	--	5	NA	NA.
Coal, all grades including briquets	--	4	NA	NA.
Hydrogen, helium, rare gases	2	1	NA	NA.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	875	688	NA	Mali 379; Upper Volta 300.
Kerosine and jet fuel ---- do	99	203	NA	Mali 108; Upper Volta 90.
Distillate fuel oil ---- do	753	1,272	45	Upper Volta 257; France 242.
Residual fuel oil ---- do	1,800	1,328	84	France 432; Greece 214.
Lubricants ---- do	98	104	NA	Upper Volta 17; Ghana 17.
Liquefied petroleum gas ---- do	20	13	NA	Upper Volta 5; Niger 4; Mali 3.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2	10	NA	NA.

NA Not available.
[1]Less than 1/2 unit.

Table 3.—Ivory Coast: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	3	NA	NA.
Metal including alloys, all forms	7,413	8,564	65	Cameroon 5,304; France 1,930.
Chromium oxides and hydroxides	11	23	NA	NA.
Copper metal including alloys, all forms	1,260	1,500	8	France 1,375; Belgium-Luxembourg 35.
Iron and steel metal:				
Scrap	1,850	209	NA	NA.
Pig iron including cast iron	14	4	NA	NA.
Sponge iron, powder, shot	56	134	NA	NA.
Ferroalloys:				
Ferromanganese	25	15	NA	NA.
Other	14	7	NA	NA.
Steel, primary forms	12,728	10,874	--	France 10,873.
Semimanufactures:				
Bars, rods, angles, shapes, sections	55,404	78,325	NA	France 63,389; Spain 4,937.
Universals, plates, sheets	55,777	59,189	NA	France 49,255; Japan 6,081.
Hoop and strip	1,536	1,737	241	France 1,206; Sweden 115.
Rails and accessories	613	2,766	--	France 2,511; Belgium-Luxembourg 16.
Wire	3,152	3,577	NA	France 1,930; Senegal 554.
Tubes, pipes, fittings	27,282	48,438	114	France 20,187; West Germany 13,223.
Casting and forgings, rough	1,076	16	NA	NA.
Lead:				
Oxides	310	204	--	All from France.
Metal including alloys, all forms	504	187	NA	France 76.
Magnesium metal including alloys, all forms value, thousands	--	$1	NA	NA.
Manganese:				
Ore and concentrate	802	1,078	NA	Mexico 900; Ghana 137.
Oxides	1,270	1,102	--	France 732; Ireland 370.
Mercury 76-pound flasks	7	145	NA	NA.
Nickel metal including alloys, all forms	272	11	NA	NA.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$1	$7	NA	NA.
Silver metal including alloys, unwrought and partly wrought do.	$697	$1,063	NA	France $978.
Tin:				
Oxides	1,450	NA	NA	NA.
Metal including alloys, all forms	22	24	NA	France 15.
Titanium:				
Ore and concentrate	16	--		
Oxides	359	404	NA	West Germany 144; Italy 66; France 48.
Zinc:				
Oxides and peroxides	22	70	NA	France 60.
Metal including alloys, all forms	3,184	4,080	NA	France 2,768; Belgium-Luxembourg 804.
Other:				
Ores and concentrates	--	3	NA	NA.
Metals:				
Metalloids	--	8	NA	NA.
Alkali, alkaline-earth, rare-earth metals	--	7	NA	NA.
Base metals including alloys, all forms	--	10	NA	France 5.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	83	22	NA	NA.
Artificial corundum	NA	59	NA	NA.
Grinding and polishing wheels and stones	109	154	NA	Italy 50; France 45; West Germany 10.
Asbestos, crude	6	6	NA	NA.
Barite	3,243	3,505	476	United Kingdom 1,245; Ireland 882; India 697.
Boron materials:				
Crude natural borates	210	412	400	NA.
Oxide and acid	--	1	NA	NA.
Cement thousand tons	1,033	1,069	(1)	France 548; Spain 317; Poland 76.
Chalk	3,077	3,337	NA	France 2,976.
Clays and clay products:				
Crude	553	873	NA	France 158.
Products:				
Refractory including nonclay brick	570	777	NA	France 612; Belgium-Luxembourg 38.
Nonrefractory	6,098	10,453	NA	Italy 4,563; France 3,596.

See footnotes at end of table.

Table 3.—Ivory Coast: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Diamond, all grades ---- carats	45,000	--		
Diatomite and other infusorial earth	310	384	--	France 289; West Germany 70.
Feldspar, fluorspar, etc	10	5	NA	NA.
Fertilizer materials:				
Crude, phosphatic	7,175	9,314	NA	Senegal 9,293.
Manufactured:				
Nitrogenous	11,455	16,786	NA	France 15,585; Poland 1,000.
Phosphatic	1,079	4,559	NA	Senegal 3,149; France 1,353.
Potassic	30,936	52,868	NA	Israel 22,801; Belgium-Luxembourg 11,463; Spain 10,076.
Other including mixed	12,179	9,748	9,627	NA.
Ammonia	3,451	5,410	--	France 3,922; Netherlands 1,467.
Graphite, natural	--	3	NA	NA.
Gypsum and plasters	49,451	73,163	--	Spain 26,260; France 24,490; Morocco 22,413.
Lime	6,314	6,124	NA	France 3,904; Belgium-Luxembourg 1,839.
Magnesite	18	1	NA	NA.
Mica:				
Crude including splittings and waste	NA	9	NA	NA.
Worked including agglomerated splittings	NA	1	NA	NA.
Pigments, mineral:				
Crude, natural	111	135	NA	NA.
Iron oxides, processed	86	139	NA	West Germany 95.
Salt	36,267	38,852	NA	Senegal 34,875; West Germany 3,500.
Sodium and potassium compounds, n.e.s:				
Caustic potash	NA	140	NA	NA.
Caustic soda	NA	10,081	--	France 2,536; West Germany 2,458; Italy 1,500.
Soda ash	NA	949	NA	France 599; East Germany 330.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,354	3,968	NA	Italy 3,905.
Worked	1,336	2,795	NA	Italy 2,528; France 56.
Dolomite, chiefly refractory grade	NA	5,178	NA	France 3,769.
Gravel and crushed rock	2,763	4,329	--	Italy 3,739; France 539.
Quartz and quartzite	NA	33	NA	NA.
Sand excluding metal-bearing	--	189	--	France 176.
Sulfur:				
Elemental, all forms	5,337	8,750	--	France 8,744.
Sulfuric acid, oleum	49	31	NA	NA.
Talc, natural steatite, soapstone	1,558	1,030	NA	France 767; Norway 243.
Other:				
Crude	--	5,491	NA	West Germany 5,489.
Slag, dross, and similar waste, not metal-bearing	--	38,336	--	France 38,286; Liberia 50.
Oxides, hydroxides, peroxides of strontium, magnesium, barium	NA	1,114	--	Ireland 1,111.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	4,641	4,104	--	France 2,037; Canada 1,638.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	72	34	NA	NA.
Coal, all grades including coke and briquets	199	110	NA	NA.
Carbon black	NA	252	--	France 141; West Germany 104.
Hydrogen, helium, rare gases	15	7	NA	NA.
Peat including briquets and litter	85	91	NA	NA.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	11,823	11,955	--	Nigeria 3,992; Venezuela 3,016; Iraq 2,650.
Refinery products:				
Gasoline ---- do	403	467	2	Canada 128; Italy 122; Romania 76.
Kerosine ---- do	23	99	NA	Italy 42; Netherlands 27.
Distillate fuel oil ---- do	170	622	--	Italy 157; Canada 139; France 115.
Residual fuel oil ---- do	23	(1)	NA	NA.
Lubricants ---- do	347	240	38	France 87; Trinidad and Tobago 70.
Other:				
Mineral jelly and wax do	7	9	NA	West Germany 5; Netherlands 2.
Bituminous mixtures ---- do	--	34	--	Venezuela 25; France 7.

See footnotes at end of table.

Table 3.—Ivory Coast: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum —Continued				
Refinery products —Continued				
Other —Continued				
Liquefied petroleum gas thousand 42-gallon barrels	5	19	--	France 9; Italy 8.
Unspecified ----------do----	287	267	NA	Venezuela 198; France 59.
Mineral tar and other coal-, petroleum-, or gas-drived crude chemicals----------	673	1,874	NA	Netherlands 1,388; France 342.

NA Not available.
[1]Less than 1/2 unit.

MALI

In 1980, Mali's mineral industry contributed only a small portion of the GNP of about $1 billion,[8] although there was a small increase in 1980. The industry consisted of a small gold mine operation, modest phosphate and salt mines, the quarrying of building materials, and grinding of imported clinker.

The Sindicat Franco-Malien de Récherches Minières, formed by Société Nationale de Récherches Minières (Sonarem) with the BRGM for geological exploration, was exploring for copper, gold, tin, and diamonds in various areas of the country.

Bauxite.—Péchiney made feasibility studies for mining bauxite in three areas between Kenieba and Bamako, believed to contain deposits of more than 1 billion tons. The Manantali River Dam project would provide the necessary electric power, if completed.

Gold.—Production started at the reactivated Kalana Mine at the rate of 400 kilograms per year, due to rise to about 1,800 kilograms per year. Reserves were estimated at 24 tons of gold. Mining was by the Government-owned Sonarem, with technical assistance from the Soviet Union.

Hydroelectric Power.—The Selinque Dam was partly operational in 1980, providing 9 megawatts in addition to 36 megawatts available previously. By 1982, capacity of the dam was to be 60 megawatts.

Iron Ore.—There were plans to develop two iron ore deposits in the southwest of the country, near the Senegal border. The Bafing-Makana deposit was estimated by Soviet geologists to contain 150 million tons of ore with 36% to 67% iron content. The Soviet group worked on feasibility studies for the deposit. The other deposit, located on the right bank of the Falème River an extension of the Senegalese Falème deposit, was investigated by the French BRGM, which estimated reserves of 8 million tons. Both deposits need improvements of regional infrastructure, such as the Manantali River power project, roads, and railroads, for exploitation to be economic.

Petroleum.—Esso Oil Co., Elf-Aquitaine, and Murphy Oil were all prospecting in various areas of the country in strata similar to the oil-bearing zones in neighboring Algeria. The Government was also preparing a geological map of the country with foreign assistance.

Phosphate Rock.—Sonarem, after having mined 2,000 tons per year of phosphate rock in the Tilemsi Valley, 150 kilometers north of Gao, was raising production to 10,000 tons per year; feasibility studies were continued on raising production to 240,000 tons per year. Reserves were estimated at 25 million tons with 27% P_2O_5. The French Fonds d'Aide de Coopération was also financing a project to extract 20,000 tons per year from the Tamaguillet deposit.

Uranium.—Japan's Power Reactor and Nuclear Fuel Development Corp. and Cogema, a subsidiary of France's Commisariat á l'Énergie Atomique (CEA), have both had exploration rights in various parts of the country and after several indications of the presence of uranium, continued their exploration activities.

NIGER

In 1980, Niger's economy, with an estimated GNP of over $2.5 billion,[9] continued its rapid growth, propelled, among other things, by the doubling of uranium production (1979 to 1980) and increases in the related transportation and service sectors.

The 650-kilometer-long "Uranium Road," to link the mines in the north of the country to existing road networks, was recently completed at a cost of $190 million. Foreign donors were financing the ongoing hard-surfacing of one section of the east-west axis that remained unpaved.

In 1980, the Government published its first 5-year plan, covering 1979 to 1983. For the mineral industry, the plan targeted large investments, while recognizing the important role of private enterprise and foreign investors in reaching its goals.

Coal.—The Société Nigérienne du Charbon was completing a $125 million coal mine and powerplant project at the Anou Araren deposit near the city of Agadés, estimated to contain 6 million tons of coal. Coal was already being mined and stockpiled in anticipation of startup in 1981 of a plant with a capacity of 16 megawatts, to double in the near future; coal output is to reach 200,000 tons per year. In its second stage, the electric powerplant will save one-half of the country's oil imports and supply the mining region plus the City of Agadés with power.

Petroleum.—Esso and Texaco Oil Co. negotiated with Elf-Aquitaine for performing additional exploration in the eastern Lake Chad and northern Djado regions. Recent exploration has been fruitless.

Tin.—The Société Minière du Niger produced about 80 tons of tin in cassiterite concentrates at two locations, Tarrouadji and Elmeki, in the Aïr Mountains. There were plans to expand operations.

Uranium.—In 1980, Niger was one of the world's largest producers and exporters of uranium, with Government earnings reaching $122 million, but this was expected to fall in 1981 as Niger's sales price drops closer to depressed world market levels. It was expected that uranium exports would continue to provide at least 75% of the country's foreign trade receipts in the near future. The Niger Government holds equity participation in all present uranium mining concessions through its National Minerals Office (Onarem), although this is not required by law and is apparently negotiable. Niger's estimated uranium reserves exceeded 160,000 tons and have attracted, to date, exploration efforts by 16 foreign companies from 9 different countries. Even as recently as mid-1979, there were three different groups planning to begin new mine construction. Included among these were the SMTT group, with operating permits and financing settled, the CEA group with plans for the Ajlit area, and a Nigerian-French-American (Conoco) consortium which planned to exploit the Imouraren deposit. However, as a result of the recent severe decline in world uranium prices, all three of these projects were postponed.

There were two operating mines in Niger in 1980. The first mine, Arlit, was located in the Aïr region in the northwest, and was operated by the Société des Mines de l'Aïr, a consortium that included the Government's Onarem (33%), CEA's subsidiary Cogema (27%), the Compagnie Française des Minerais de l' Uranium (11.8%), Mokta (7.6%), Minatome (7.6%), Urangesellschaft (6.5%), and Agip Nucléaire (6.5%). The Arlit deposit consists of a 20- to 25-meter-thick stratum of clay and sandstone with 0.25% U_3O_8 under a 40- to 50-meter overburden. It contains some coffinite with pitchblende. Capacity of the Arlit Mine was 1,800 tons of uranium in 1980 and is to increase to 2,300 tons in 1982.

The second uranium mine was the Akouta Mine, located 20 kilometers from the Arlit Mine. It is owned by the Compagnie Minière d' Akouta, a consortium composed of Cogema (34%), Onarem (31%), the Overseas Uranium Resources Development Co. of Japan (25%), and the Empresa Nacional del Uranio of Spain (10%). The underground mine exploits deposits at a 250-meter depth with 0.4% U_3O_8, but similar otherwise to those at Arlit. Capacity was 2,200 tons of U_3O_8 in 1980. The mine also produces 450 tons per year of molybdenum as a byproduct.

SENEGAL

In 1980, the Government launched a 5-year recovery program that it hopes will reverse Senegal's declining economic performance by financial constraint and a tight monetary policy. The plan was a condition for a $270 million, 3-year financing facility

from the International Monetary Fund, which dominated Senegal's economy. In 1980 the GNP decreased to $2.1 billion.[10] The mineral industry's contribution to this total was about 14%, consisting mainly of phosphates.

Iron Ore.—There were plans to develop an iron ore mine by 1987 at the Falème iron ore deposit, on the country's southeastern border, which was estimated to contain about 400 million tons of magnetite with 48% Fe, and 100 million tons of hematite with over 63% Fe. Feasibility studies indicate a production of 10 million tons of iron ore per year for 20 years. The project was undertaken by the Mines de Fer du Sénégal Oriental composed of the Government (28.5%), the BRGM (23.8%), Kanematsu Gosho (23.8%), and Krupp (23.8%). The BRGM is the project's operator.

Marble.—In 1980, the Société d'Exploitation des Marbres du Sénégal was formed to produce marble in eastern Senegal from reserves of 350,000 tons, which may ultimately be expanded to 1 million tons. The present small production is to be expanded to 30,000 tons of marble per year.

Petroleum.—The Government has not given up hope of finding oil in the country and was assisted in this effort by Chevron, Shell, and Elf-Aquitaine. In the meantime, a feasibility study was prepared for exploiting the heavy oil deposit in the coastal waters off Casamance, estimated to contain 100 million tons.

Phosphate Rock.—While phosphate production dropped 15% in 1980, because of slack demand, rising world prices pulled export earnings up 16%. To obtain added value from its phosphate resources, Senegal began construction in April of a phosphatic fertilizer complex, consisting of plants for the production of 560,000 tons of sulfuric acid, 220,000 tons of phosphoric acid, 45,000 tons of superphosphate, and 300,000 tons of ammonium phosphate; it will process 650,000 tons of phosphate rock per year. The project, termed Industries Chimiques du Sénégal, was slated for completion in 1984 and was expected to earn $110 million each year.

The largest of Senegal's two phosphate rock producers was the Compagnie Sénégalaise des Phosphates de Taïba, 50% Government-owned; the other owners were Coframines (BRGM) (15.6%), IMC (11.1%), Cofimer (7.8%), Omnium de Produits Chimiques pour l'Industrie et Agriculture (4.7%), the Caisse des Depôts et Consignations (4.5%), and Rhône Poulenc's subsidiary, the Compagnie Industrielle et Minière (2.9%). The mine is located at the Ndomour Diop deposit in the Tivouane area. Capacity is to increase from 1,650,000 tons of phosphate rock per year to 2,100,000 tons per year in 1982. Production was shifted in 1980 to the Keur Mor Fall pit, an extension of the Taiba deposit, involving a temporary drop in production to 1.3 million tons per year. Shareholders and France's CCCE financed the changeover. The second of two phosphate operations was that of the Société Sénégalaise des Phosphates de Thiés, also 50% Government-owned, with Péchiney as equal partner. The Pallo deposit near Thiés was the source of the production of about 120,000 tons of calcium phosphate and about 225,000 tons of aluminum phosphate in 1980, the latter being the only known such production in the world.

TOGO

In 1980 Togo's economy grew an estimated 8%, and the GNP was an estimated $850 million.[11] The mineral industry, producing mainly phosphate rock, contributed about 40% of the country's export earnings. In 1980, Togo's modern port at Lomé handled 1 million tons of cargo. A $40 million expansion of the port was underway and was scheduled for completion in 1981.

Cement.—In 1980, the Cimao cement clinker plant, located 80 kilometers north of Lomé, started operation. The 1.2-million-ton-per-year plant, jointly owned by the Governments of Togo, Ghana, and the Ivory Coast, used limestone from the 155-million-ton deposit at Tabligbo. An 80-kilometer rail line linked it to the Port of Lomé. Financing of the project was by the World Bank; it was hoped to double the plant's capacity in the 1980's.

Petroleum.—The Togolese Government continued to encourage oil exploration by interested companies, but no oil had been found by yearend. In the meantime, the country's 1-million-ton-per-year oil refinery, managed by the Government's Société Togolaise des Hydrocarbures, continued to operate on Nigerian crude and operated near capacity in 1980.

Phosphate Rock.—In 1980, in a major

reorganization of the Government-owned phosphate industry, the Government's phosphate mining company Compagnie Togolaise des Mines du Bénin, was joined with its phosphate-marketing unit, the Office Togolais des Phosphates, under the latter's name. In 1980, the industry shipped over 3.3. million tons of phosphate rock from deposits located near the coast in the Kahotoe and Kpogame areas where phosphate rock reserves were estimated to exceed 100 million tons. The crude rock was processed nearby at the Kpome processing plant, which was expanded in 1980 by a fifth processing line. In 1980, production is expected to reach 3.6 million tons.

UPPER VOLTA

In 1980, Upper Volta continued to be one of Africa's poorest nations, with no significant mining activity. The GNP was estimated at $1.1 billion[12] corresponding to a growth of 2.5% in real terms. Although the mineral sector contributed virtually nothing to the GNP, several mineral deposits were known or were being explored. Copper, molybdenum, lead, and zinc were known in the Boromo and Hunde regions, 200 kilometers southwest of the capital, where the UNDP was involved. Near the eastern frontier at Abobo-Djouna and Kodjari a potential for a phosphate deposit with possible reserves of 200 million tons was found.

Gold.—At the beginning of 1981, work started to reopen the Poura gold mine located 180 kilometers southwest of Ougadougou. According to feasibility studies reserves at the mine were estimated to contain 25 tons of gold. About 4 years of site preparations were necessary before mining can recommence. Two other gold deposits have been found in the country recently, one located at Kwademen in the south, and the other in the northeast. The UNDP assisted in the exploration.

Manganese Ore.—The Tambao manganese ore deposit, located in the northeast, was estimated to contain more than 13 million tons of high-grade manganese ore with 50% to 55% Mn, and a further 13 million tons of carbonate ore with 48% Mn. The property was leased to the Société Minière de Tambao by the Government, which owns 51% of the equity; the balance was owned by Thyssen AG (West Germany) and Tamco (Japan). Investment plans were postponed indefinitely because of high infrastructure costs (railroad, etc.) and uncertain world market conditions.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Communauté Financière Africaine francs (CFAF) to U.S. dollars at the rate of CFAF211.30=US$1.00 for 1980.

[3]Where necessary, values have been converted from Cape Verde escudos to U.S. dollars at the rate of escudos 39=US$1.00 for 1980.

[4]Where necessary, values have been converted from Gambian delasi (GD) to U.S. dollars at the rate of GD2.2=US$1.00 for 1980.

[5]Where necessary, values have been converted from Guinean syli (GS) to U.S. dollars at the rate of GS18.93=US$1.00 for 1980.

[6]Where necessary, values have been converted from Guinea-Bissau pesos (GBP) to U.S. dollars at the rate of GBP35=US$1.00 for 1980.

[7]Prepared by E. Shekarchi, supervisory physical scientist, Branch of Foreign Data.

[8]Where necessary, values have been converted from Mali francs (MF) to U.S. dollars at the rate of MF426=US$1.00 for 1980.

[9]See footnote 2.

[10]See footnote 2.

[11]See footnote 2.

[12]See footnote 2.

The Mineral Industry of the Islands of the Caribbean

By Doris M. Hyde[1]

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Bahamas	1197	Haiti	1216
Barbados	1201	Jamaica	1218
Bermuda	1206	Martinique and Guadeloupe	1224
Cuba	1207	Netherlands Antilles	1224
Dominican Republic	1212	Trinidad and Tobago	1225

There were no significant changes in the mineral industries of the smaller Caribbean Islands during 1980. Imported petroleum requirements continued to erode economic gains that may have occurred in other sectors. Some relief may be forthcoming as more qualified Caribbean countries take advantage of Trinidad and Tobago's petroleum product financing program (see Trinidad and Tobago). There were no crude oil discoveries in these areas during 1980, although some geophysical testing around the British Virgin Islands and Antigua was underway.

In March 1980, the Government of Antigua sold a 75% interest in the 16,000-barrel-per-day West Indies Oil Co. refinery to the Swiss Intermaritime Bank and Intermaritime Management Services for $6 million. The new refinery company is called the National Petroleum Co. Shutdown since 1976, it was originally planned for the refinery to reopen in 1980, but refurbishing has proved to be more extensive than anticipated. The reopening is now expected in 1981.

The Amerada Hess crude oil transshipment terminal on St. Lucia was not completed during 1980, but it was expected to become operational in 1981. Construction has not yet begun on the Hess refinery which would complete the planned petroleum complex on the island.

BAHAMAS

In 1980, the mineral industries continued to have little effect on the Bahamian economy which remains strongly influenced by the tourist and banking sectors. The real gross national product (GNP) was estimated at almost $1.1 billion in 1979, showing a real growth rate of about 8%, down from the 11% growth registered in 1978.

The Diamond Crystal Salt Co. reported that they will close down the salt facility on Long Island at the end of their fiscal year in September 1981. Both Diamond Salt Co. and Morton Salt Co., located on Great Inagua Island, suffered production setbacks because of a large tropical storm in 1979.

In 1980, it was reported that Lone Star

Industries, Inc., had agreed in principle to acquire for $11 million, a 50% interest in the 800,000-ton-per-year Bahamas Cement Co. The cement company was sold in 1978 to International Development Corp., S.A., by United States Steel Corp. which had closed the plant in 1977.

In December 1980, Geophysical Service Inc. (GSI), a subsidiary of Texas Instruments, Inc., received a contract for a nonexclusive seismic survey of areas between the Bahamas and Florida. The survey will involve about 2,500 line miles and include areas near Bimini, Cay Sal, and north of Grand Bahama Island. The information will be used by the Government to prepare for an offshore lease sale expected to be held about midyear 1981. Some petroleum experts believe there is a deep basin below the Bahamas that could offer a high oil potential. The permit issued to GSI is the first under the new petroleum regulations enacted in 1978.

The Charter Co. has apparently been successful in moving the Bahamas Oil Refining Co. to a more profitable position and has reportedly secured additional crude oil supplies from Alaskan sources.

Table 1.—Islands of the Caribbean: Production of mineral commodities[1]

Area,[2] commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
BAHAMAS[3]					
Cement, hydraulic thousand metric tons	271	r70	330	450	4520
Petroleum refinery products:[e]					
Jet fuel thousand 42-gallon barrels	7,708	9,935	9,160	9,000	NA
Distillate fuel oil do.	8,928	21,452	9,885	9,500	NA
Residual fuel oil do.	36,099	53,032	34,565	35,000	NA
Other do.	10,791	15,939	11,080	11,000	NA
Refinery fuel and losses do.	707	888	900	900	NA
Total do.	64,233	101,246	65,590	65,400	NA
Salt thousand metric tons	1,353	1,670	1,633	440	4684
Stone:					
Aragonite do.	2,069	2,454	3,200	3,629	43,266
Limestone, for cement manufacture do.	35	NA	524	508	600
Sulfur, byproduct of petroleum do.	r5	r e5	r e5	r e5	5
BARBADOS[3]					
Gas, natural:					
Gross[e] million cubic feet	158	197	444	r548	4584
Marketed do.	e152	e130	152	266	300
Petroleum:					
Crude thousand 42-gallon barrels	110	124	272	285	4204
Refinery products:					
Gasoline do.	311	328	333	348	350
Kerosine do.	71	62	60	59	60
Distillate fuel oil do.	378	229	267	283	300
Residual fuel oil do.	279	518	496	551	550
Other do.	33	30	35	31	30
Refinery fuel and losses do.	126	137	18	23	20
Total do.	1,198	1,304	1,209	1,295	1,310
CUBA[3 5]					
Cement, hydraulic thousand metric tons	2,500	2,657	2,712	2,613	3,500
Chromite do.	19	20	29	28	30
Cobalt:[e] metric tons	1,600	1,600	1,600	1,700	1,700
Copper, mine output, metal content do.	2,898	2,583	2,821	2,840	3,000
Gas, natural:					
Gross[e] million cubic feet	1,220	r1,330	r1,500	r1,500	1,560
Marketed do.	r752	r599	374	614	750
Gypsum thousand metric tons	85	91	95	91	122
Iron and steel: Crude steel do.	r250	r330	324	328	330
Nickel:					
Mine output, Ni content of oxide and sulfide metric tons	r37,020	r36,750	34,787	32,324	37,000
Metallurgical products, Ni content:					
Oxide and powder do.	6,380	6,928	6,726	6,306	6,300
Sinter do.	9,129	8,666	8,615	9,776	9,800
Sulfide do.	9,236	9,062	8,240	6,636	8,900
Nitrogen, N content of ammonia thousand metric tons	80	58	39	155	200
Petroleum:					
Crude thousand 42-gallon barrels	r1,562	r1,705	1,918	1,917	2,000
Refinery products:					
Motor gasoline do.	r7,730	7,083	7,537	7,412	NA
Kerosine do.	r3,518	3,220	3,308	3,213	NA

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities[1] —Continued

Area,[2] commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
CUBA[3 5] —Continued					
Petroleum —Continued					
Refinery products —Continued					
Distillate fuel oil, thousand 42-gallon barrels	[r]7,176	7,428	8,080	8,163	NA
Residual fuel oil ——do	[r]19,551	21,376	20,650	21,400	NA
Lubricating oils ——do	[r]725	841	885	930	NA
Liquefied petroleum gas ——do	1,048	1,124	1,179	1,069	NA
Other ——do	4,994	5,095	4,782	4,325	NA
Total ——do	[r]44,742	46,167	46,421	46,512	NA
Pyrite, gross weight ——thousand metric tons	64	82	54	29	30
Sulfur:					
S content of pyrite[e] ——do	[r]27	[r]34	[r]23	[r]12	13
Byproduct of petroleum[e] ——do	8	8	8	8	8
Total ——do	[r]35	[r]42	31	20	21
DOMINICA					
Stone, sand and gravel: Pumice and volcanic ash ——do	109	109	109	109	109
DOMINICAN REPUBLIC[3]					
Aluminum: Bauxite, dry equivalent, gross weight ——do	[r]621	[r]576	568	524	[4]510
Cement, hydraulic ——do	654	862	867	886	[4]1,015
Copper, mine output ——do	--	--	--	3	3
Gold ——thousand troy ounces	[r]413	[r]343	343	353	[4]370
Gypsum:					
For cement manufacture, thousand metric tons	218	224	170	173	185
Other ——do	2	2	[e]2	[e]2	2
Iron and steel ferroalloys: Ferronickel, metric tons	[r]64,197	[r]65,516	37,631	66,072	[4]43,019
Lime ——do	[r]22,047	[r]21,108	[r e]25,000	37,935	40,000
Mercury ——76-pound flasks	--	495	500	500	500
Nickel:					
Mine output, metal content ——metric tons	[r e]24,399	[r e]24,899	[r e]14,302	[r e]25,111	[4]16,347
Metal, smelter, Ni content of ferronickel shipments ——do	[r]24,399	[r]24,899	14,302	25,111	[4]16,347
Petroleum refinery products:					
Gasoline ——thousand 42-gallon barrels	2,728	2,738	2,814	2,568	[4]2,497
Kerosine and jet fuel ——do	375	353	425	505	[4]542
Distillate fuel oil ——do	2,523	2,665	2,690	2,472	[4]2,945
Residual fuel oil ——do	4,368	2,643	2,830	2,708	[4]2,636
Other ——do	1,691	613	730	782	[4]869
Refinery fuel and losses ——do	489	423	272	289	[4]352
Total ——do	12,174	9,435	9,761	9,324	[4]9,841
Salt ——metric tons	[r]36,295	[r]34,428	37,877	[r e]38,000	[4]55,556
Silver metal ——thousand troy ounces	[r]891	[r]1,852	1,848	2,276	[4]1,623
Stone, sand and gravel:					
Limestone ——thousand metric tons	272	302	353	288	[4]264
Sand and gravel ——do	1,165	1,228	1,393	[r e]1,400	1,400
GUADELOUPE					
Abrasives, natural: Pumice ——do	200	190	200	200	200
Cement ——do	136	136	162	[r e]170	200
Stone:					
Crushed and broken ——do	NA	761	[e]700	[e]700	700
Limestone ——do	NA	793	NA	[e]700	800
HAITI[3]					
Aluminum: Bauxite, dry equivalent, gross weight ——do	660	588	580	584	[4]312
Cement, hydraulic ——do	[r]246	[r]242	249	270	[4]243
Clays ——do	64	67	60	65	70
Gypsum, for cement manufacture ——metric tons	--	([6])	--	--	--
JAMAICA					
Aluminum:					
Bauxite, dry equivalent, gross weight, thousand metric tons	[r]10,296	11,433	11,777	11,505	[4]12,261
Alumina ——do	[r]1,644	[r]2,048	2,111	2,074	[4]2,478
Cement, hydraulic ——do	365	333	294	226	[4]152
Clays, for cement manufacture ——do	132	160	99	99	[4]94

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities[1] —Continued

Area,[2] commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
JAMAICA —Continued					
Gypsum ____ metric tons	253,194	214,824	134,500	58,000	[4]95,477
Lime ____ do	122	[r]144	157	204	[4]159
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels	1,189	1,879	1,998	1,745	1,750
Kerosine ____ do	482	349	349	379	380
Jet fuel ____ do	481	480	560	847	850
Distillate fuel oil ____ do	1,831	1,858	1,977	1,954	1,950
Residual fuel oil ____ do	3,789	2,391	2,498	4,164	4,200
Liquefied petroleum gas ____ do	281	255	233	413	420
Other ____ do	212	140	301	99	100
Refinery fuel and losses ____ do	243	1,504	1,170	321	350
Total ____ do	8,508	8,856	9,086	9,922	10,000
Sand and gravel:					
Glass sand ____ thousand metric tons	[r]30	[r]28	14	11	[4]6
Common sand and gravel ____ do	[r]9,558	[r]9,558	9,558	11,000	10,000
Stone:					
Limestone ____ do	868	717	614	370	[4]403
Other ____ do	1	[e]914	1,128	8,200	[4]6,280
MARTINIQUE					
Cement, hydraulic ____ do	119	129	131	[e]130	130
Clays ____ do	[e]27	27	38	45	45
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels	NA	1,149	1,176	1,269	1,270
Kerosine ____ do	NA	177	126	121	120
Jet fuel ____ do	NA	798	893	706	700
Distillate fuel oil ____ do	NA	454	561	581	600
Residual fuel oil ____ do	NA	935	990	1,093	1,100
Liquefied petroleum gas ____ do	NA	NA	242	241	250
Total ____ do	NA	NA	3,988	4,011	4,040
Pumice:					
As reported ____ thousand cubic meters	480	477	261	277	240
Converted[e] ____ thousand metric tons	[r]300	287	[r]166	[r]156	120
Stone, sand and gravel:					
Stone, crushed and broken thousand cubic meters	[e]300	349	471	555	600
Sand ____ do	[e]250	261	149	228	300
MONTSERRAT					
Sand and gravel, natural ____ cubic meters	5,402	3,161	11,570	12,523	12,500
Other quarry products[7] ____ do	8,103	3,393	702	r [e]1,000	1,000
NETHERLANDS ANTILLES[3]					
Nitrogen, N content of ammonia thousand metric tons	84,076	[r]30,705	--	--	--
Petroleum refinery products:					
Gasoline:					
Aviation -- thousand 42-gallon barrels	1,276	1,202	1,530	[e]1,600	NA
Motor ____ do	15,120	17,223	18,172	[e]19,000	NA
Kerosine ____ do	5,906	353	432	[e]500	NA
Jet fuel ____ do	16,316	12,908	15,317	[e]16,000	NA
Distillate fuel oil ____ do	21,635	24,660	28,055	[e]29,000	NA
Residual fuel oil ____ do	119,283	100,265	110,996	[e]115,000	NA
Lubricants ____ do	4,221	3,355	3,355	[e]3,400	NA
Other ____ do	28,948	25,280	26,961	[e]27,000	NA
Refinery fuel and losses ____ do	13,264	12,264	9,928	[e]10,000	NA
Total ____ do	225,969	197,510	214,746	[e]221,500	NA
Phosphate rock ____ thousand metric tons	54	79	81	49	--
Salt[e] ____ do	480	400	400	400	400
Sulfur, byproduct of petroleum ____ do	95	94	95	95	95
ST. VINCENT					
Salt ____ do	50	50	50	50	50
Sand and gravel, natural thousand cubic meters	413	413	[e]410	400	400
Other quarry products ____ do	764	764	[e]760	750	750
TRINIDAD AND TOBAGO[8]					
Asphalt, natural ____ thousand metric tons	[r]65	44	58	39	40
Cement, hydraulic ____ do	[r]238	[r]215	220	216	200
Clays:					
Argillite ____ thousand cubic meters	68	121	[e]130	--	--

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities[1] —Continued

Area,[2] commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
TRINIDAD AND TOBAGO[8]—Continued					
Clays —Continued					
Other ——— thousand cubic meters	(9)	89	e90	109	120
Gas, natural:					
Gross ——— million cubic feet	137,959	r149,590	157,958	169,740	185,000
Marketed ——— do	r64,552	r76,611	89,077	87,485	95,000
Natural gas liquids thousand 42-gallon barrels	53	e50	60	50	50
Nitrogen: N content of ammonia — metric tons	162,870	176,454	400,772	388,654	400,000
Petroleum:					
Crude ——— thousand 42-gallon barrels	77,673	83,950	83,773	78,249	78,000
Refinery products:					
Gasoline:					
Aviation ——— do	319	361	354	271	300
Other ——— do	10,187	18,355	16,795	9,932	10,000
Kerosine ——— do	6,864	5,802	4,501	3,245	3,000
Jet fuel ——— do	4,281	2,462	2,219	7,415	7,500
Distillate fuel oil ——— do	12,161	10,705	10,134	11,741	12,000
Residual fuel oil ——— do	67,797	56,296	45,478	43,521	43,000
Lubricants ——— do	824	926	725	686	700
Other:					
Liquefied petroleum gas ——— do	404	465	610	759	700
Asphalt ——— do	130	201	173	275	280
Unspecified ——— do	11,331	3,415	2,045	1,974	2,000
Refinery fuel and losses ——— do	3,297	3,010	2,848	3,045	3,000
Total ——— do	117,595	101,998	85,882	82,864	82,480
Sand and gravel:					
Pitch sand ——— thousand cubic meters	207	46	e45	68	70
Other sand and gravel ——— do	360	642	e500	529	550
Stone:					
Andesite ——— do	—	881	NA	15	16
Diorite ——— do	1	NA	NA	498	500
Limestone:					
For cement manufacture thousand metric tons	395	323	e350	295	300
Other ——— thousand cubic meters	NA	445	e450	1,056	1,100
Porcelanite ——— do	27	e27	e27	94	100
Sulfur, byproduct of petroleum[10] thousand metric tons	r74	r34	54	77	80

eEstimated. pPreliminary. rRevised. NA Not available.

[1]Table includes data available through June 23, 1981.

[2]In addition to the countries listed, Antigua, Bermuda, Grenada, and St. Lucia presumably produced crude construction materials (clays, sand and gravel, and stone), but output is not reported and available information is inadequate to make reliable estimates of output levels. Antigua also has a petroleum refinery that was closed in 1976 but may be operational again in 1981.

[3]In addition to the commodities listed, other crude construction materials (lime, salt, and sand and gravel) may also be produced, but data on such production are not collected and available information is inadequate to make reliable estimates of output levels.

[4]Reported figure.

[5]In addition to the commodities listed, iron ore and manganese ore, both produced in significant quantities prior to the termination of publication of official statistics, presumably were produced during the period covered by this table, but available information is inadequate to make reliable estimates of output levels.

[6]Revised to none.

[7]Includes crushed volcanic rock, limestone, diorite, and quartzite used for building stone, aggregate, road construction, etc.

[8]Trinidad and Tobago initiated production of pig iron and sponge iron near yearend 1980 and may also have produced a small quantity of steel, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[9]Less than 1/2 unit.

[10]Limited quantities of sulfur as a byproduct of natural gas may also be produced.

BARBADOS

Preliminary information indicates that in 1980 growth in the gross domestic product (GDP) was about 4% or 5%, in real terms, down from the 7.3% growth experienced in 1979 when the GDP reached $574 million. Nonfuel industrial mineral production has not expanded significantly and the sector exerts only a small influence on the economy which is dominated by tourism and agriculture. A heavy dependence on imports has also made Barbados susceptible to external economic changes and has complicated Government efforts to control factors affecting the domestic economy.

Crude oil production was valued at slightly over $3 million in 1979, but the 1980 value, estimated at $5.9 million, was substantially higher in view of significant price adjustments. First quarter figures for 1980 imported crude oil and partly refined oil

indicated a trebling of cost over the same period in 1979, mainly as a result of successive price increases during the intervening time. The Government continued to encourage an increased use of domestic natural gas resources. Only 48% of natural gas production was marketed or otherwise used in 1979, but in 1980 the Government began integrating natural gas into the power system of the Barbados Light and Power Co. to provide additional energy for home use and 53% of total production was consumed.

The 250,000-ton-per-year cement clinker grinding project to be jointly owned by the Governments of Barbados and Guyana has been cancelled. However, Barbados did join in a venture with the Government of Trinidad and Tobago to construct a similar facility. Construction was scheduled to begin in 1981 and be completed in 1983.

Interpretations of an offshore seismic survey begun in December 1979 indicated possible oil deposits. The potential reservoirs reportedly lie in areas where the water depth reaches 2,000 feet, a condition which would complicate drilling and recovery.

Table 2.—Barbados: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Aluminum sulfate ____ kilograms__	383	29	__	All to St. Christopher-Nevis-Anguilla.
Metal including alloys:				
Scrap _____	7	49	49	
Unwrought and semimanufactures _____	60	35	34	Remainder to St. Lucia and Trinidad and Tobago.
Copper:				
Ore and concentrate _____ value__	__	$103	__	All to Antigua.
Metal including alloys:				
Scrap _____	79	45	20	West Germany 14; Belgium-Luxembourg 8; Canada 3.
Unwrought and semimanufactures _____ kilograms__	4,166	406	__	St. Vincent 254; St. Lucia 102.
Iron and steel metal:				
Scrap _____	438	521	2	Venezuela 432; United Kingdom 87.
Pig iron, ferroalloys, similar materials value__	$30	__		
Semimanufactures _____	42	[1]423	(2)	St. Lucia 261; St. Vincent 107; St. Christopher-Nevis-Anguilla 30.
Lead metal including alloys, scrap ____	130	144	61	Trinidad and Tobago 65; United Kingdom 17; West Germany 1.
Tantalum metal including alloys, all forms _____ value__	$1,535	$239	$239	
Zinc metal including alloys, unwrought and semimanufactures __ kilograms__	102	__		
Other: Oxides _____	9	29	__	Dominica 17; Trinidad and Tobago 11.
NONMETALS				
Abrasives: Grinding and polishing wheels and stones _____ kilograms__	55	101	__	United Kingdom 92; Canada 8; St. Vincent 1.
Barite and witherite _____ value__	$24	__		
Cement _____	1	8	__	St. Vincent 4; St. Lucia 2; Grenada 2.
Clays and clay products:				
Crude _____	53	6	__	All to French West Indies.
Products:				
Refractory (including nonclay brick) _____	2	1	__	All to Grenada.
Nonrefractory[3] _____	2	1,492	__	Trinidad and Tobago 379; Jamaica 357; French West Indies 284.
Diatomite and other infusorial earth ___	__	46	__	All to Guyana.
Fertilizer materials:				
Crude, potassic _____ value__	$36	$135	__	All to St. Vincent.
Manufactured _____ do____	$1,469	$588	__	St. Lucia $386; St. Christopher-Nevis-Anguilla $171; Dominica $31.
Ammonia _____ kilograms__	376	272	__	St. Vincent 148; Grenada 68; Montserrat 51; St. Christopher-Nevis-Anguilla 5.
Gypsum and plasters _____	1	1	__	Mainly to St. Vincent.
Lime _____	74	56	__	St. Lucia 55; St. Vincent 1.
Magnesite _____	__	3	(2)	Grenada 2; Antigua 1.
Pigments, mineral, crude _____	__	9	__	All to Trinidad and Tobago.
Salt _____	1	6	__	Mainly to Montserrat.
Sodium and potassium compounds, n.e.s.:				
Caustic soda _____ kilograms__	__	45	__	All to St. Vincent.
Soda ash _____ do____	45	247	__	Dominica 151; St. Christopher-Nevis-Anguilla 51; St. Vincent 45.

See footnotes at end of table.

Table 2.—Barbados: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel:				
Dimension stone:				
Crude ---------- kilograms	254	33,174	--	All to St. Vincent.
Worked ----------	8	33	--	St. Vincent 31.
Limestone except dimension ------	5,740	4,036	(2)	Trinidad and Tobago 3,596; Guyana 305; Grenadines 64.
Gravel and crushed rock --------	235	249	--	Trinidad and Tobago 198; St. Lucia 51.
Sand excluding metal-bearing ---------- value	$40	$114	--	St. Lucia $104; Canada $10.
Strontium minerals: Strontianite kilograms	36	[4]302	--	St. Lucia 101; St. Christopher-Nevis-Anguilla 101; Grenada 100.
Sulfur:				
Elemental ---------- do	5	25	--	Grenada 11; Antigua 7; St. Vincent 7.
Sulfuric acid including oleum -----	1	3	--	St. Vincent 1; Grenada 1.
Other:				
Crude ---------- kilograms	39	92	--	All to St. Lucia.
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetals n.e.s ----------	3	72	--	St. Christopher-Nevis-Anguilla 68; St. Lucia 3.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural -- value	--	$47	--	All to St. Vincent.
Coal, all grades, including briquets ---	1	4	--	Mainly to St. Lucia.
Gas, manufactured ------ cubic feet	3	2	--	All to Dominica.
Hydrogen, helium, rare gases kilograms	132	792	--	St. Vincent 395; St. Lucia 227; Dominica 170.
Petroleum:				
Crude and partly refined 42-gallon barrels	NA	26,000	--	All to Trinidad and Tobago.
Refinery products:[5]				
Gasoline ---------- do	[r]12,632	5,390	--	All for bunkers.
Kerosine ---------- do	NA	2	--	Do.
Jet fuel ---------- do	308,356	807,989	--	Do.
Distillate fuel oil ----- do	261,336	286,506	594	United Kingdom 8,071; St. Vincent 1,201.
Residual fuel oil ------ do	227,412	307,329	--	United Kingdom 7,364; U.S.S.R. 3,828; Greece 2,414.
Lubricants ---------- do	3,390	3,232	1	United Kingdom 227; St. Lucia 69; St. Vincent 45.
Other:				
Liquefied petroleum gas do	66	49	--	St. Vincent 4.
Mineral jelly and wax do	25	9	--	St. Vincent 4; Montserrat 2.
Unspecified ------ do	35	26	--	Antigua 14; St. Vincent 7.
Total ---------- do	NA	1,410,532		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ---------- kilograms	204	574	--	St. Lucia 544; Grenada 30.

[r]Revised. NA Not available.
[1]Excludes quantity valued at $5,666.
[2]Less than 1/2 unit.
[3]Partial figures; exclude glazed and unglazed ceramic tiles valued at $78,729 in 1977 and $33,640 in 1978.
[4]Excludes quantity valued at $2,337 exported to Trinidad and Tobago.
[5]Includes bunkers.

Table 3.—Barbados: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide ----------	1	3	--	United Kingdom 2; Canada 1.
Metal including alloys, all forms ------	559	896	637	Canada 135; United Kingdom 101; West Germany 16.
Beryllium metal including alloys, all forms kilograms	51	--		
Copper metal including alloys, all forms	52	80	12	United Kingdom 62; Canada 6.
Gold metal including alloys, rolled on base metal or silver ---------- troy ounces	--	336	336	

See footnotes at end of table.

Table 3.—Barbados: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Iron and steel metal:				
Scrap	53	46	--	United Kingdom 37; Antigua 9.
Pig iron, ferroalloys, similar materials	341	55	(1)	West Germany 52; United Kingdom 3.
Steel, primary forms	27	4,819	79	United Kingdom 4,740.
Semimanufactures:				
Bars, rods, angles, shapes, sections	5,322	4,613	24	United Kingdom 4,292; Japan 137; Brazil 71.
Universals, plates, sheets	3,291	10,911	90	United Kingdom 9,210; Japan 809; Belgium-Luxembourg 232.
Hoop and strip	99	458	4	Belgium-Luxembourg 267; Japan 150; United Kingdom 37.
Rails and accessories	value— $4,193	--		
Wire	283	508	12	Japan 278; West Germany 111; Belgium-Luxembourg 68.
Tubes, pipes, fittings	2,239	3,480	433	United Kingdom 2,131; Canada 841.
Castings and forgings, rough	3	4	1	United Kingdom 3.
Lead metal including alloys:				
Scrap	10	--		
Unwrought	20	51	(1)	Trinidad and Tobago 41; United Kingdom 10.
Semimanufactures	24	64	(1)	United Kingdom 64.
Magnesium metal including alloys, all forms	kilograms— 10,008	2 51	51	
Nickel metal including alloys:				
Scrap	1	--		
Unwrought and semimanufactures	2	2	1	Canada 1.
Platinum-group metals including alloys, all forms	troy ounces— 170	(3)	--	All from United Kingdom.
Silver metal including alloys, all forms	do— 4,872	4,442	80	Canada 2,322; United Kingdom 2,040.
Tantalum metal including alloys, all forms	4	4	4	
Tin metal including alloys, all forms	11	9	1	China, mainland, 4; United Kingdom 4.
Tungsten metal including alloys, all forms	value— $395	$56	$56	
Zinc metal including alloys:				
Scrap	5	--		
Blue powder	kilograms— --	457	--	All from United Kingdom.
Unwrought	(1)	20	--	Do.
Semimanufactures	1	4	(1)	Canada 2; United Kingdom 2.
Other:				
Oxides, n.e.s.	469	500	190	United Kingdom 115; Spain 62; West Germany 59.
Pyrophoric alloys	kilograms— 32	37	24	Japan 10.
Metals including alloys, all forms, n.e.s.	value— $314	$284	$215	United Kingdom $69.
NONMETALS				
Abrasives, natural, n.e.s.:				
Pumice, emery, natural corundum, etc.	kilograms— 1,727	1,676	1,626	United Kingdom 50.
Grinding and polishing wheels and stones	2	8	4	United Kingdom 3.
Asbestos	7	6	(1)	Switzerland 5.
Barite and witherite	99	750	204	Trinidad and Tobago 546.
Cement	43,462	46,544	280	Cuba 38,997; Colombia 6,882; United Kingdom 222.
Chalk	49	65	1	United Kingdom 64.
Clays and clay products:				
Crude	15	541	79	United Kingdom 415; Trinidad and Tobago 47.
Products:				
Refractory (including nonclay brick)	171	66	10	United Kingdom 56.
Nonrefractory[4]	17	158	12	Brazil 109; Italy 32.
Diamond, gem, not set or strung	carats— 1,076	1,132	--	All from Guyana.
Diatomite and other infusorial earth	50	1,612	1,612	
Feldspar and fluorspar	kilograms— --	221	--	All from United Kingdom.
Fertilizer materials:				
Crude	value— $5,509	$422	$35	United Kingdom $387.
Manufactured:				
Nitrogenous	2,299	1,248	3	Trinidad and Tobago 1,078; Dominican Republic 137.
Phosphatic	6	5 1	--	All from United Kingdom.
Potassic	866	2	1	United Kingdom 1.
Other including mixed	5,932	10,567	2,442	Netherlands 4,708; West Germany 1,927; Dominican Republic 1,154.
Ammonia	14	18	3	United Kingdom 11; Trinidad and Tobago 2; Netherlands 2.
Graphite, natural	kilograms— 77	201	--	All from United Kingdom.
Gypsum and plasters	87	58	--	United Kingdom 57; Trinidad and Tobago 1.

See footnotes at end of table.

Table 3.—Barbados: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Lime	281	724	4	United Kingdom 511; Jamaica 209.
Magnesite value	$94	$553	$14	United Kingdom $451; West Germany $88.
Mica, all forms	23	48	13	United Kingdom 16; Norway 11; Canada 6.
Pigments, mineral	5	2	1	United Kingdom 1.
Precious and semiprecious stones except diamond:				
Natural carats	699	2,094	--	All from India.
Synthetic do	--	606	--	Do.
Salt	2,232	2,003	34	Jamaica 600; United Kingdom 518; Canada 495.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	181	277	199	Trinidad and Tobago 50; United Kingdom 24; West Germany 2.
Soda ash	5	13	1	United Kingdom 11.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	24	44	(1)	Italy 44.
Worked	94	2	(1)	St. Lucia 1.
Dolomite, chiefly refractory grade	1	--		
Gravel and crushed rock	257	353	101	Canada 226; Ireland 18.
Limestone except dimension	2	9	5	United Kingdom 4.
Quartz and quartzite	1	2	2	
Sand excluding metal-bearing	118	44	16	Trinidad and Tobago 27.
Strontium minerals: Strontianite	48	17	(1)	United Kingdom 17.
Sulfur:				
Elemental kilograms	--	3	3	
Sulfur dioxide do	150	702	699	United Kingdom 3.
Sulfuric acid including oleum	101	146	26	Trinidad and Tobago 95; United Kingdom 15.
Talc, steatite, soapstone, pyrophyllite	28	50	17	Norway 28; West Germany 5.
Other:				
Crude	73	34	34	
Halogens and sulfur compounds, n.e.s	3	3	3	
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetals, n.e.s	434	516	125	Canada 324; Brazil 30.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	33	2	2	
Coal, all grades, including briquets	99	37	37	
Coke and semicoke	64	20	--	All from United Kingdom.
Gas, manufactured cubic feet	64	32	1	United Kingdom 31.
Hydrogen, helium, rare gases	4	42	41	United Kingdom 1.
Peat including briquets and litter	25	25	--	Ireland 16; United Kingdom 9.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	924	783	--	Venezuela 683; Belgium-Luxembourg 52; Netherlands 48.
Refinery products:				
Gasoline do	146	90	--	Netherlands 45; Netherlands Antilles 34; Trinidad and Tobago 11.
Kerosine do	7	20	(1)	Trinidad and Tobago 20.
Jet fuel do	521	489	--	Trinidad and Tobago 386; Netherlands Antilles 103.
Distillate fuel oil do	264	330	--	Netherlands Antilles 212; Trinidad and Tobago 118.
Residual fuel oil do	331	230	--	All from Netherlands Antilles.
Lubricants do	16	635	50	United Kingdom 194; Trinidad and Tobago 160; Netherlands Antilles 101.
Other:				
Liquefied petroleum gas do	90	93	2	Trinidad and Tobago 48; Venezuela 21; Netherlands Antilles 18.
Mineral jelly and wax do	--	1	(1)	Remainder mainly from Trinidad and Tobago.
Unspecified do	3	7	4	Canada 1; New Zealand 1; Trinidad and Tobago 1.
Total do	1,378	1,895		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	45	1	--	All from United Kingdom.

[1]Less than 1/2 unit.
[2]This quantity, valued at $611, excludes a quantity imported from Canada valued at $1,372.
[3]Value only reported at $94.
[4]Excludes quantities of glazed and unglazed ceramic tiles valued at $1,081,491 in 1977 and $350,221 in 1978.
[5]Excludes quantity valued at $1,760.

BERMUDA

The mineral industry on this tight cluster of small islands collectively known as Bermuda is practically nonexistent. It consists of minor quantities of sand and limestone used for local construction purposes. There have been no reports of companies interested in petroleum exploration in this area.

Table 4.—Bermuda: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations/sources, 1979	
			United States	Other (principal)
EXPORTS				
Petroleum refinery products (all bunker loadings):[1]				
Gasoline:				
Aviation thousand 42-gallon barrels	554	928	--	All to Bermuda.
Motor do	(2)	(2)	--	Do.
Jet fuel do	5	9	--	Do.
Distillate fuel oil do	238	411	--	Netherlands Antilles 386; Bermuda 25.
Total do	797	1,348		
IMPORTS				
METALS				
Aluminum metal including alloys, all forms	9	31	14	United Kingdom 15.
Copper metal including alloys, all forms	11	5	2	Canada 3.
Iron and steel metal:				
Pig iron, sponge iron, ferroalloys	(3)	1	1	
Steel:				
Primary forms thousand tons	13	14	8	United Kingdom 6.
Blooms, billets, slabs, sheet, bars	50	5	--	All from United Kingdom.
Semimanufactures:				
Universals, plates, and sheets, uncoated	--	632	621	United Kingdom 11.
Castings and forgings, rough	251	58	58	
Lead metal including alloys, all forms kilograms	841	664	367	United Kingdom 297.
Nickel metal including alloys, all forms do	NA	132	41	Canada 91.
Platinum-group and silver metals including alloys, unwrought or partly wrought:				
Platinum-group troy ounces	(2)	1	1	
Silver do	9	28	20	United Kingdom 4; Canada 4.
Tin metal including alloys, all forms	5	22	1	Remainder mainly from United Kingdom.
Zinc metal including alloys, all forms	2	1	1	
Other, nonferrous	(2)	1	1	
NONMETALS				
Abrasives: Grinding and polishing wheels and stones kilograms	269	610	386	United Kingdom 187.
Cement	17,721	7,986	5	Bahamas 7,922; United Kingdom 59.
Clays and clay products:				
Clays and other refractory materials	91	65	52	United Kingdom 12.
Clay brick	1,015	820	405	Italy 163; United Kingdom 140.
Diamond, gem, not set or strung carats	153	179	78	United Kingdom 101.
Fertilizer materials:				
Crude	82	19	(2)	Remainder mainly from Canada.
Manufactured:				
Nitrogenous	4	35	35	
Phosphatic	(2)	--		
Mixed	834	757	427	Canada 231; United Kingdom 99.
Gypsum and plasters	328	317	104	Canada 211.
Lime	534	356	341	Canada 15.
Precious and semiprecious stones except diamond:				
Natural value	$95,203	$77,313	$38,418	West Germany $15,863; United Kingdom $11,817.
Manufactured do	$1,106	$2,032	$1,996	Mexico $36.
Salt	127	132	38	Canada 77; United Kingdom 17.
Stone, sand and gravel:				
Dimension stone	201	101	32	United Kingdom 55; Canada 14.
Gravel and crushed rock	61,281	15,164	15,164	Do.
Sand	3,838	62,471	24,271	Canada 38,200.

See footnotes at end of table.

Table 4.—Bermuda: Foreign trade in selected mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations/sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Coal and coke including briquets	218	22	22	
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	386	176	(2)	Netherlands Antilles 176.
Kerosine do	2	2	(2)	Netherlands Antilles 2.
Distillate fuel oil do	1,680	835	(2)	Venezuela 657; Netherlands Antilles 178.
Lubricants do	14,049	505	444	Jamaica 60.
Other:				
Greases do	(2)	(2)	(2)	Remainder mainly from Canada.
Asphalt and bitumen do	(2)	(2)	(2)	Remainder mainly from Canada.
Bunker fuel oil do	649	983	67	Netherlands Antilles 878.
Total do	16,766	2,501		

NA Not available.
[1]Bunkers originating with NATO and the British and United States Armed Forces.
[2]Less than 1/2 unit.
[3]Value only reported at $288.

CUBA

Cuba ended its first 5-year plan (1976-80) with an overall economic growth rate estimated at 4%, lower than the 6% envisaged when the plan was formulated. Several unforseen factors combined to slow economic growth. They include: agricultural and animal diseases; increased energy costs; structural deficiencies in the administration of the various sectors of the economy, which resulted in inefficient management and low productivity; and a deterioration of terms of trade with countries not members of the Council for Mutual Economic Assistance (CEMA).

In regards to the latter, it has been estimated that non-CEMA trade terms, while for the most part sustaining volumes, have deteriorated by 53% during the last 5 years and resulted in less foreign exchange being earned than during the previous 5-year period. Cuba's balance of trade with non-CEMA countries indicates a trend toward more balanced exchanges, although still on the deficit side. Export trade with CEMA member countries has increased from 68% in 1975 to over 80% in 1979. The U.S.S.R.'s share of trade rose from 48% to about 67% during this period. Trade dependence with CEMA countries continues to grow, but Cuba's new economic plans include future projects designed to diversify and increase its trading opportunities with non-CEMA countries.

The rising cost of oil imports was one of the causes for Cuba's economic difficulties. In 1979, Cuba imported about 46.4 million barrels of crude oil, slightly less than in 1978. Early in 1980, Cuba reported that the cost of petroleum imports in 1980 was expected to be between $2.5 billion and $3 billion at current market prices. Since Cuba purchases petroleum through the U.S.S.R. at a discount, it is assumed that the actual cost to Cuba would be less than the above figure.

In early 1980, after strong self-criticism regarding administrative and economic deficiencies, Cuba began reforming its administrative structure. The reorganization emphasis was on establishing a clear centralization of command with the 13 members of the executive committee of the Council of Ministers dividing responsibility for the supervision, control, and coordination of all the ministries and State agencies.

In the latter part of 1980, laws were passed that affected industrial relations. Enterprises were given more control over the hiring of workers, a process which had been subject to various regulations obstructing timely, cost-efficient operations. Also, employees are now required to sign individual contracts defining their responsibilities. Piecework payment methods and bonuses have also been introduced in some instances, and this incentive measure may

be expanded if studies reveal favorable results.

In mid-1980, Cuba unveiled the new 1981-85 5-year plan that included references to the work and pay incentive measures later enacted and discussed above. The new plan also placed considerable emphasis on industrialization, including the development of mineral resources as raw material for future processing and end-use industries. Increased nickel and cobalt production were considered to be of strategic importance. The iron ore resulting from nickel extraction will eventually be utilized as the basis for a steel industry. Copper, along with the other metal production, will be used as material for establishing domestic machinery and equipment manufacture and decreasing or eliminating import needs. All of the industrialization set forth in the plan was not projected to occur during the 1981-85 period, but represents the first steps toward future planning.

Electrical power requirements were recognized in the plan and the construction of nuclear plants was advanced as the probable means to satisfy much of the future demand.

COMMODITY REVIEW

In 1980, Cuba continued to enter into cooperative projects with non-CEMA countries. It was reported that French companies have obtained the right to prospect for gold, lead, zinc, and other metals. Other French cooperative projects that may materialize include a fertilizer plant at Cienfuegos; a $500 million, 60,000-ton-capacity, stainless steel project in Oriente Province; and a thermoelectric plant at Santa Cruz del Norte. Financing arrangements and other specifics of any final decision to proceed with these projects have not yet been revealed. Bulgaria was reported to be increasing their assistance towards nonferrous metals prospecting in the Santa Clara region.

Metals.—*Iron and Steel.*—The second-stage expansion of the José Marti steel complex at El Cotorro was scheduled for completion in July 1981. This expansion will increase raw steel capacity to 350,000 tons per year and finished steel capacity to about 300,000 tons per year. A third expansion stage has been proposed that would bring raw steel capacity to 675,000 tons per year.

The first gray iron and malleable cast iron foundry in Cuba is under construction at the City of Guantánamo. Using Polish technology, this plant is projected to cost about $16 million. Output of machined elements, connectors for aqueducts, grating, and other items are expected to reduce demands for foreign exchange and eliminate delivery delays.

Nickel.—Cuba announced that construction at the new Punta Gorda nickel refinery has fallen behind schedule. Delays were attributed to labor problems, infrastructural deficiencies, and the management of the project. This plant, which is projected to have a 30,000-ton-per-year capacity of nickel oxides, was scheduled to come onstream in 1981, followed shortly thereafter by a second nickel oxide plant at Las Camariocas. Revised scheduling places the Punta Gorda plant onstream by late 1983, with full production of 30,000 tons per day by 1985. Then, if the planned expansions at the Nicaro (to 22,500 tons per year of nickel-cobalt oxides) and Moa (to 24,000 tons per year of nickel-cobalt sulfide) plants are completed, 1985 capacity from the three plants is expected to be 76,500 tons per year.

The Las Camariocas plant has also fallen behind schedule and may not be completed until 1990, at which time total capacity from the four plants would be 106,500 tons per year.

Nonmetals.—*Cement.*—In May 1980, the first production line of the new Karl Marx Cement Plant, in the Guabairo zone of the Cienfuegos Province, went onstream. The second and third production lines were to begin testing before the end of the year. This plant, with a projected cost of more than $205 million, has a capacity of 1.65 million tons per year.

A new cement plant was under construction adjacent to the 350,000-ton-per-year Rene Arcay Cement Plant. The new plant, basically an expansion of the Rene Arcay plant, was scheduled for completion in 1980 with an annual capacity of 1.4 million tons per year. Completion of this plant and the Cienfuegos plant will raise Cuba's total cement capacity to about 5.6 million tons per year.

Stone.—The new El Cacao Rock Crushing Plant, located near Santa Rita in Granma Province, and the Alacranes plant expansion in Matanzas Province, were scheduled for completion in 1980. The combined total capacity of these plants will be about 1.2 million cubic meters per year of crushed rock, processed sand, granite, and aggregate.

The sodium feldspar plant at Holguín was to go into operation in September 1980, after 4 years of construction activity and an estimated cost of $3.5 million. The plant will employ 58 workers to produce 18,000 tons of sodium feldspar per year. Output will be used as raw material for a glass packaging plant in Las Tunas and a sanitary fixtures factory in Holguín.

Mineral Fuels.—*Petroleum.*—Based on officially released Cuban statistics, revisions have been made regarding the production of crude oil and are reflected in table 1. Published information in trade journals continued to show considerable variance.

One of the important fuel-related activities in Cuba was the December 1980 agreement with Mexico for cooperation in petroleum affairs. The agreement provides for an exchange of petroleum products and derivatives, Mexican technical assistance in expanding the catalytic cracking section of Havana's Nico Lopez refinery to increase production of liquid gas, and a joint offshore exploration program of the continental shelf areas of the Yucatán Peninsula, Caribbean Sea, and an area north of Cuba. Exploration work was expected to begin immediately and include seismic surveys and drilling. This agreement marks Mexico's first foreign exploratory program.

As part of the French cooperative agreement mentioned earlier, Société Nationale Elf Aquitaine was awarded rights to explore for and produce petroleum. The Finnish State-owned oil company Neste Oy, was also reported to have been invited to negotiate for offshore exploration rights.

Table 5.—Cuba: Apparent exports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum:			
Bauxite	--	277	All to Belgium-Luxembourg.
Metal including alloys:			
Scrap	389	725	Netherlands 562; Italy 78.
Unwrought	672	--	
Semimanufactures	--	30	All to Spain.
Chromium: Chromite	28,937	16,045	Poland 5,077; Czechoslovakia 5,000; Austria 4,893.
Copper:			
Ore and concentrate	3,482	--	
Metal including alloys:			
Scrap	479	539	Belgium-Luxembourg 274; Netherlands 174.
Semimanufactures	21	207	Saudi Arabia 205.
Iron and steel metal:			
Scrap	96	29	Netherlands 18.
Ferroalloys	52	--	
Steel, primary forms	NA	1,627	All to Venezuela.
Semimanufactures:			
Plates and sheets	NA	728	Venezuela 718.
Wire	30	--	
Tubes, pipes, fittings	r28	86	Saudi Arabia 72.
Lead metal including alloys:			
Scrap	55	18	All to Netherlands.
Unwrought	2	--	
Nickel:			
Matte and speiss	10,876	9,888	Netherlands 3,822; West Germany 2,471; Italy 1,804.
Metal including alloys:			
Scrap	124	--	
Unwrought	2,217	3,788	Japan 1,217; Spain 909; Italy 621.
Semimanufactures	--	35	All to Spain.
Silver metal including alloys, unworked or partly worked, value, thousands	$371	$1,980	All to Switzerland.
Zinc metal including alloys, scrap	69	80	Belgium-Luxembourg 45; Netherlands 35.
Other:			
Ores and concentrates, n.e.s	4,882	5,000	All to Hungary.
Ash and residue containing nonferrous metals	489	569	Netherlands 415; Belgium-Luxembourg 154.
Oxides, hydroxides, peroxides	3,894	3,220	Italy 2,914; Netherlands 207.
NONMETALS			
Cement	450	53,442	Venezuela 48,942.
Clays and clay products:			
Crude	NA	677	All to Venezuela.
Products, refractory	202	--	
Precious and semiprecious stones, value, thousands	$35	--	
Stone, sand, and gravel:			
Dimension stone	30	142	Italy 122.
Gravel and crushed rock	--	3	All to Saudi Arabia.

See footnotes at end of table.

Table 5.—Cuba: Apparent exports of mineral commodities[1 2]—Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	2,459	1,436	Netherlands 745; West Germany 281.
Residual fuel oil do	--	11	All to the West Germany.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11,556	--	

[r]Revised. NA Not available.

[1]Owing to the lack of official trade data published by Cuba, this table should not be taken as a complete presentation of Cuba's mineral exports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Data are compiled from offical trade statistics of individual trading partners.

Table 6.—Cuba: Apparent imports of mineral commodities[1 2]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum:			
Bauxite	175	--	
Oxide and hydroxide	21	356	Japan 330; West Germany 20.
Metal including alloys:			
Unwrought	1,291	1,581	Hungary 1,425; United Kingdom 156.
Semimanufactures	2,292	4,559	Hungary 2,548; Belgium-Luxembourg 1,891.
Antimony metal and regulus	33	--	
Chromium oxides and hydroxides	--	2	All from United Kingdom.
Cobalt:			
Oxide and hydroxide	1	--	
Metal including alloys, all forms	2	1	All from West Germany.
Copper:			
Copper sulfate	100	23	All from Yugoslavia.
Metal including alloys:			
Unwrought	20	--	
Semimanufactures	1,568	3,823	Japan 1,344; United Kingdom 923; West Germany 787.
Iron and steel:			
Ore and concentrate	--	231	Netherlands 150; United Kingdom 81.
Metal:			
Scrap	83,699	72,347	All from U.S.S.R.
Ferroalloys	1,102	950	All from West Germany.
Semimanufactures:			
Bars, rods, angles, shapes, sections	25,766	53,186	Czechoslovakia 21,000; Belgium-Luxembourg 7,980; Poland 7,631.
Plates and sheets	17,597	20,816	Japan 7,523; Hungary 4,969; Poland 2,671; Spain 2,372.
Hoop and strip	107	350	France 239; West Germany 94.
Rails and accessories	492	917	France 908.
Wire	4,151	12,998	Belgium-Luxembourg 4,263; West Germany 3,935.
Tubes, pipes, fittings	7,593	9,070	France 2,631; Japan 1,957; West Germany 1,861.
Castings and forgings, rough	960	267	Japan 185; Spain 81.
Unspecified thousand tons	[3]779	NA	
Lead:			
Oxide	1,031	350	All from France.
Metal including alloys:			
Unwrought	1,003	599	All from Belgium-Luxembourg.
Semimanufactures	229	407	Belgium-Luxembourg 320; West Germany 86.
Magnesium metal including alloys, semimanufactures	--	1	All from Spain.
Manganese:			
Ore and concentrate	2	--	
Oxides	667	419	Japan 350; United Kingdom 69.
Mercury 76-pound flasks	--	29	All from France.
Nickel metal including alloys, semimanufactures	6	5	Japan 3; West Germany 2.

See footnotes at end of table.

Table 6.—Cuba: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Platinum-group metals including alloys, unwrought or partly wrought value, thousands	--	$2	All from United Kingdom.
Silver metal including alloys, unwrought or partly wrought do	--	$97	All from Spain.
Tin metal including alloys, unwrought	7	1	Do.
Titanium:			
Oxide	72	--	
Metal including alloys, all forms kilograms	--	48	All from Japan.
Tungsten metal including alloys, all forms do	10	--	
Zinc:			
Oxide and peroxide	1,324	30	All from Belgium-Luxembourg.
Metal including alloys:			
Unwrought	55	200	Do.
Semimanufactures	29	4	Austria 3.
Other:			
Oxides, hydroxides, peroxides, n.e.s	71	32	Canada 31.
Metals including alloys, all forms:			
Metalloids	181	--	
Base metals, all forms, n.e.s	41	10	All from Italy.
NONMETALS			
Abrasives:			
Natural: Pumice, emery, natural corundum, etc	15	11	Italy 10.
Grinding and polishing wheels and stones	91	203	Spain 196.
Artificial corundum	NA	10	Spain 8.
Asbestos	3,651	1,832	All from Canada.
Barite and witherite	--	100	Netherlands 71; United Kingdom 29.
Boron materials: Oxide and acid	--	24	France 23.
Cement	[3]90,000	79,188	U.S.S.R. 79,000.
Clays and clay products:			
Crude	2,091	412	Italy 238; Japan 102.
Products:			
Refractory (including nonclay brick)	38,625	43,251	U.S.S.R. 37,096; Spain 2,966; United Kingdom 2,434.
Nonrefractory	65	119	Spain 100.
Diamond, gem, not set or strung value, thousands	--	$3	All from United Kingdom.
Diatomite and other infusorial earth	252	251	Japan 192; Italy 59.
Feldspar and fluorspar	569	447	France 371; Spain 76.
Fertilizer materials:			
Crude, phosphatic	15,000	[4]8,000	All from U.S.S.R.
Manufactured:			
Nitrogenous	568,856	509,694	U.S.S.R. 509,684.
Phosphatic	266,373	261,866	All from U.S.S.R.
Potassic	185,025	136,966	U.S.S.R. 132,958.
Other including mixed	--	10	All from Belgium-Luxembourg.
Ammonia	--	10	All from Japan.
Graphite, natural	5	--	
Gypsum and plasters	111	93	All from West Germany.
Iodine	--	4	Netherlands 3.
Lime	14	15	All from Japan.
Magnesite	179	52	West Germany 20; Netherlands 20.
Mica, all forms	192	140	United Kingdom 120.
Pigment minerals: Processed iron oxides	226	381	Spain 220; West Germany 126.
Precious and semiprecious stones value, thousands	$41	$18	Switzerland $16.
Salt	3	2,005	Canada 2,000.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[3]31,800	6,307	Netherlands 5,000; France 700.
Caustic potash	83	74	All from Japan.
Soda ash	12,609	21,006	All from Bulgaria.
Stone, sand and gravel:			
Dimension stone, worked	12	--	
Quartz and quartzite	2	30	Spain 20; West Germany 10.
Sand	143	11	Belgium-Luxembourg 10.
Sulfur:			
Elemental	[3]155	17,763	Canada 17,713.
Sulfuric acid	17	7	West Germany 6.
Other:			
Crude	3	12	Spain 10.
Oxides of magnesium, strontium, barium	8	3	All from Japan.
Halogens	3	679	Canada 678.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	19	--	
Carbon black	161	4,142	U.S.S.R. 3,976.

See footnotes at end of table.

Table 6.—Cuba: Apparent imports of mineral commodities[1] [2] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
MINERAL FUELS AND RELATED MATERIALS —Continued			
Coal, anthracite and bituminous	[3]91,000	394	All from Japan.
Coke and semicoke	[3]49,000	552	Do.
Petroleum:			
Crude thousand 42-gallon barrels	[3]46,421	2,879	All from Venezuela.
Refinery products:			
Gasoline do	[3]1,785	33	Mainly from Italy.
Distillate fuel oil do	[3]5,603	2	Yugoslavia 1.
Residual fuel oil do	[3]14,646	3	All from Yugoslavia.
Lubricants do	[3]812	26	Venezuela 19.
Other:			
Liquefied petroleum gas do	NA	21	All from Venezuela.
Mineral jelly and wax do	NA	3	Japan 2; Netherlands 1.
Unspecified do	13	NA	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	369	378	All from United Kingdom.

NA Not available.

[1]Owing to the lack of official trade data published by Cuba, this table should not be taken as a complete presentation of Cuba's mineral imports. These data have been compiled from various sources which include United Nations information and data published by the trading partners.

[2]Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[3]Statistical Yearbook of the Member States of the Council for Mutual Economic Assistance, Moscow.

[4]The British Sulphur Corporation Limited. Statistical Supplement, London.

DOMINICAN REPUBLIC

Revised data indicate that the rate of growth in the GDP of the Dominican Republic in 1979 was 3.7%, in real terms, instead of the 5.3% estimated earlier. However, preliminary reports show the 1980 GDP at almost $2.9 billion, indicating a real growth rate of 5.6% for that year. The Dominican economy is subject to external economic influences, particularly world inflation and rising petroleum prices.

In 1979, the three major mineral commodities, bauxite, ferronickel, and doré bullion, accounted for about 31% of the total export earnings. In 1980, these three products accounted for an estimated 40% of total exports. This increase in mineral export value was due entirely to strong gains in the world market price of gold and silver. Despite a lengthy plant shutdown, ferronickel exports were off 18% in value owing to stock selloff and marginally increased prices. Export volumes of all three commodities declined in 1980.

Value of mineral exports (in millions of U.S. dollars)

Commodity	1977	1978	1979	1980[e]
Bauxite	22.0	23.4	20.9	19.8
Doré	59.6	76.9	127.8	259.5
Ferronickel	93.0	75.2	123.4	101.3
Total	174.6	175.5	272.1	380.6
Percent of total exports	22.4	26.0	31.3	39.5

[e]Estimated.

Petroleum import costs were less than anticipated early in 1980, but even so, increased from $315 million in 1979 to almost $449 million in 1980, accounting for about 31% of the estimated cost of all imports. Petroleum costs were largely responsible for the doubling of the trade balance deficit in 1980. A shutdown of the ferronickel plant for 5 months during 1980 and slightly reduced domestic gasoline consumption were the reasons for this lower-than-anticipated oil import bill. The recent Venezuela-Mexico agreement to provide concessional financing for 30% of the cost of crude petroleum that they sell to Caribbean and Central American countries should diminish the impact of future price increases on the balance-of-payments.

Aluminum Co. of America (Alcoa) and the Government concluded their long-delayed renegotiation on bauxite production taxes and royalty payments. The new contract will remain in force through 1982 and provided that Alcoa pay the Government $17 per ton of bauxite produced plus a royalty payment of $0.60 on each ton exported. Although there was an isolated report that the Cabo Rojo operation might be closed down, Alcoa denied the allegation.

After completing a feasibility study in 1980, the Government announced it would proceed with the construction of a gold and silver refinery. It was maintained that domestic refining would promote new end-use industries and encourage the exploitation of

virtually untouched alluvial gold deposits. It was estimated that a refinery capable of processing current Dominican gold production would cost about $3 million. Construction was scheduled to start before 1981 but the plant site was not announced.

Responding to a depressed world market for ferronickel, Falconbridge Dominicana C. por A. (Falcondo) shutdown their Bonao Mine and plant at the end of July 1980. Originally announced as a 3-month closure, the plant was idle throughout the remainder of the year. Increasing petroleum prices were cited as the major reason that direct production costs have risen to about $3 per pound of nickel, and continued operation would have resulted in unacceptable net losses to the company. Falcondo continued workers salaries and assigned them to maintenance and other duties.

Coal has become more frequently mentioned as an acceptable alternative energy source to petroleum. Late in 1980 it was announced that major "coal" deposits had been identified at Sanchez, near the head of Sabana Bay in the northeast. Information on the quality and quantity was not made available. It is well-known that there are deposits of lignite in this area, but it is not thought that these are the deposits referred to as "coal." It was also announced that in the future only coal-fired thermal electric generating plants would be constructed; whether the newly discovered domestic "coal" or solely imported coal would be used for fuel is not yet clear.

Canadian Superior, Ltd., completed their studies in the Barahona Basin area, about 100 miles west of Santo Domingo, and expected to spend $7 million to drill a 15,000-foot wildcat early in 1981. Anschutz Corp. replaced Weeks Petroleum Co. as the fourth partner in the Carboil Corp. consortium and its interest in the San Juan Basin, located to the north of the Barahona Basin. A test well has been planned for the San Juan area after the Superior test has been drilled. A seismic survey of the area was contracted to Western Geophysical Co. The San Juan Basin extends into Haiti where Anschutz also holds an exploration concession. Western Geophysical has expressed its own interest in conducting offshore surveys which would become Government property with Western to receive compensation should any company use the data. Other companies, including Gulf Oil Co., Mobil Oil Co., Marathon Oil Co., and Société Nationale Elf Aquitaine, have indicated an interest in the onshore and offshore areas of Quisqueya State.

The Government was reported to be studying the advisability of purchasing the 50% interest held by Shell Oil Co. in the Nagua oil refinery.

Table 7.—Dominican Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	756,667	634,729	634,729	
Alumina	--	3	--	All to Spain.
Metal including alloys, all forms	140	290	51	Belgium-Luxembourg 176.
Copper:				
Matte	--	20	--	All to Republic of Korea.
Metal including alloys:				
Scrap	97	--		
Semimanufactures, kilograms	220	40	40	
Gold metal doré and bullion, thousand troy ounces	2,244	2,694	--	All to Switzerland.
Iron and steel metal:				
Scrap	747	1,349	886	Netherlands 264; Colombia 70.
Pig iron, spiegeleisen, powder, shot	--	48	48	
Ferroalloys: Ferronickel	50,007	64,500	21,146	Netherlands 21,345; Japan 15,771.
Semimanufactures	49	144	--	Haiti 96.
Lead:				
Oxide and hydroxide	--	83	--	Venezuela 47; West Germany 36.
Metal including alloys, all forms	755	12	12	
Manganese oxide and hydroxide	--	164	51	Taiwan 53; Venezuela 45; West Germany 14.
Mercury, 76-pound flasks	222	640	640	
Zinc metal including alloys:				
Blue powder	54	153	--	Belgium-Luxembourg 131.
Semimanufactures	102	105	--	All to Taiwan.
Other: Ash and residue containing nonferrous metals	--	191	--	All to Venezuela.

See footnotes at end of table.

Table 7.—Dominican Republic: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS				
Cement, hydraulic	9,647	30,852	31	St. Lucia 6,651; Guadeloupe 6,464.
Clays and clay products:				
Crude	--	35	35	
Products:				
Refractory (including nonclay brick)	484	175	174	Haiti 1.
Nonrefractory	569	714	700	Haiti 14.
Diatomite and other infusorial earth	70	55	--	All to Venezuela.
Fertilizer materials, manufactured:				
Nitrogenous	20,358	61,736	638	Martinique 14,467; Haiti 8,635.
Phosphatic	--	60	--	All to Barbados.
Potassic	1,223	911	--	Martinique 602; Barbados 291; Haiti 18.
Other including mixed	2,295	(1)	--	All to Haiti.
Gypsum and plasters	195,998	190,794	79,692	Colombia 67,314.
Lime	1,298	90	--	All to Haiti.
Pigments, mineral, natural	17	20	--	All to West Germany.
Salt	--	1,758	--	Trinidad and Tobago 1,328; Guadeloupe 430.
Sodium and potassium compounds, n.e.s	--	40	--	All to Guatemala.
Stone, sand and gravel:				
Dimension stone kilograms	--	81	36	Haiti 45.
Limestone except dimension	258,081	244,199	168,571	Suriname 75,628.
Gravel and crushed rock	--	90	90	
Sand excluding metal-bearing	150	--		
Other:				
Crude: Meerschaum, amber, jet kilograms	91	47	47	
Slag and dross from iron and steel manufacture	91	70	20	Venezuela 50.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Lubricants 42-gallon barrels	7	196	7	Netherlands Antilles 119; Jamaica 49.
Bitumen and other residues do	2,012	394	--	All to Haiti.

[1]Less than 1/2 unit.

Table 8.—Dominican Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina	130	118	115	Spain 2; Italy 1.
Metal including alloys, all forms	3,056	1,312	141	Canada 758.
Arsenic anhydride and acid	18	5	(1)	Brazil 5.
Chromium:				
Ore and concentrate kilograms	--	49	49	
Oxide and hydroxide	(1)	13	--	All from West Germany.
Cobalt oxide and hydroxide kilograms	1,448	1,187	1,002	West Germany 185.
Copper metal including alloys, all forms	1,341	1,702	286	Canada 639; Chile 519.
Gold metal, unwrought or partly wrought value	$1,579	$873	$873	
Iron and steel metal:				
Scrap	17,026	13,566	13,545	West Germany 18.
Pig iron and ferroalloys	737	886	313	Panama 250; Brazil 200.
Steel, primary forms	6,555	1,734	368	Japan 1,325.
Semimanufactures	84,936	79,337	5,700	Japan 35,599; Brazil 14,060; West Germany 7,483.
Lead:				
Oxide	445	470	6	Mexico 434; Japan 30.
Metal including alloys, all forms	228	108	19	West Germany 65; Mexico 20.
Manganese:				
Ore and concentrate	642	782	622	Mexico 160.
Oxide	166	7	4	Italy 3.
Mercury 76-pound flasks	7	4	4	
Nickel metal including alloys, all forms	4	12	1	West Germany 9.
Platinum-group metals including alloys, all forms troy ounces	--	161	161	
Selenium kilograms	--	220	--	West Germany 150; Netherlands 70.

See footnotes at end of table.

Table 8.—Dominican Republic: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Silver metal including alloys, all forms troy ounces	2,733	1,415	1,415	
Tin metal including alloys, all forms	38	41	15	West Germany 26.
Titanium oxide and hydroxide	661	1,837	764	Spain 483; United Kingdom 207; Japan 200.
Zinc:				
Ore and concentrate	99	--	--	
Oxide, hydroxide, peroxide	70	205	158	Netherlands 20; West Germany 8; Taiwan 7.
Metal including alloys, all forms	1,785	2,338	443	Canada 1,732.
Other:				
Ores and concentrates, n.e.s	7	(1)	(1)	
Oxides, hydroxides, peroxides, n.e.s	8	80	30	West Germany 18; Netherlands 11; United Kingdom 8.
Metals including alloys, all forms:				
Metalloids	42	28	16	Sweden 10; Japan 2.
Alkali, alkaline-earth, rare-earth metals	81	1,004	91	West Germany 842; Netherlands 71.
Pyrophoric alloys kilograms	565	1,634	18	West Germany 1,254; Austria 200.
Base metals including alloys, all forms	7	27	21	West Germany 6.
NONMETALS				
Abrasives:				
Natural: Pumice, emery, natural corundum, etc	101	78	56	West Germany 13.
Grinding and polishing wheels and stones	r30	28	5	Brazil 9; United Kingdom 5.
Artificial corundum	2	--	--	
Asbestos	519	485	92	Canada 390.
Barite and witherite kilograms	14,969	500	--	All from Netherlands.
Boron materials:				
Borax, natural	40	65	64	NA.
Boric acid	59	84	81	West Germany 3.
Other	(1)	18	18	
Cement, hydraulic	11,054	5,431	22	Spain 5,169.
Chalk	338	1,188	708	Colombia 420.
Clays and clay products:				
Crude	3,062	2,780	1,075	Spain 1,046.
Products:				
Refractory (including nonclay brick)	6,057	7,584	4,309	Canada 1,705; Mexico 1,506.
Nonrefractory	18	28	27	NA.
Cryolite and chiolite kilograms	--	2,875	215	Netherlands 2,660.
Diamond, gem, not set or strung carats	--	30,000	30,000	
Diatomite and other infusorial earth	1,100	760	663	Mexico 65.
Feldspar, fluorspar, leucite, nepheline	--	854	163	Canada 620.
Fertilizer materials:				
Crude, phosphatic	4	3	3	
Manufactured:				
Nitrogenous	109,770	126,657	126,621	Belgium-Luxembourg 27; Netherlands 9.
Phosphatic	8,823	19,508	19,496	Netherlands 7; Belgium-Luxembourg 5.
Potassic	23,484	17,451	17,451	
Other including mixed	16,838	14,574	12,514	West Germany 2,018.
Ammonia	201	155	131	West Germany 13; Netherlands 5.
Graphite, natural	54	2	2	
Gypsum and plasters	287	192	116	Belgium-Luxembourg 42; West Germany 34.
Lime	40	--		
Magnesite	707	--		
Mica, worked, including agglomerated splittings kilograms	4,330	3,334	313	Japan 1,698; Taiwan 822.
Pigments, mineral:				
Natural, crude	146	203	5	Belgium-Luxembourg 131; Spain 40.
Iron oxides, processed	46	114	13	Belgium-Luxembourg 40; West Germany 32; Mexico 15.
Precious and semiprecious stones except diamond, natural and synthetic value	$80	$91	$15	Mexico $76.
Salt	83	39	13	Canada 20.
Sodium and potassium compounds, n.e.s.:				
Soda ash	286	548	16	West Germany 212; France 170.
Unspecified	12,423	13,454	10,592	Spain 2,554; United Kingdom 156.
Stone, sand and gravel:				
Dimension stone	(1)	6	6	
Limestone except dimension kilograms	--	8	8	

See footnotes at end of table.

Table 8.—Dominican Republic: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Alunite	2	--		
Quartz and quartzite	17	59	59	
Sand, all types, excluding metal-bearing	331	1,942	1,933	Italy 9.
Strontium minerals	14	10	--	All from Spain.
Sulfur:				
Elemental:				
Colloidal ---- kilograms	101	540	540	
Other than colloidal	25	39	34	West Germany 4; Guatemala 1.
Sulfuric acid including oleum	3,390	1,391	1,371	Netherlands 19.
Talc, steatite, soapstone	838	812	632	Italy 152; Netherlands 15.
Other:				
Slag, dross, and similar waste not metal-bearing:				
From iron and steel manufacture kilograms	181	--		
Unspecified ---- do.	2,366	1,365	1,365	
Oxides and hydroxides of magnesium, strontium, barium	150	155	151	Italy 4.
Building materials of asphalt, asbestos- and fiber-cement, and unfired nonmetals, n.e.s	952	825	694	Mexico 40; Spain 34.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,958	77	77	
Carbon black and retort carbon	456	187	86	Canada 62.
Coal, all grades, including briquets	163	288	238	Colombia 50.
Coke and semicoke	432	1,039	327	Colombia 612; Ecuador 100.
Hydrogen, helium, rare gases	13	27	27	
Petroleum:				
Crude and unfinished oils thousand 42-gallon barrels	12,159	12,137	--	Venezuela 8,663; Netherlands Antilles 3,382.
Refinery products:				
Gasoline ---- do.	21	150	(1)	Netherlands Antilles 116; Trinidad and Tobago 33.
Kerosine and jet fuel ---- do.	(1)	9	--	Mainly from Trinidad and Tobago.
Distillate fuel oil ---- do.	62	48	(1)	Netherlands Antilles 48.
Residual fuel oil ---- do.	39	524	(1)	Honduras 251; Panama 127; Trinidad and Tobago 121.
Lubricants ---- do.	116	123	59	Netherlands Antilles 29; Jamaica 18.
Bitumen ---- do.	255	208	6	Netherlands Antilles 130; Venezuela 66.
Other ---- do.	35	41	17	Japan 15.
Total ---- do.	528	1,103		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	135	87	68	United Kingdom 10; Spain 8.

[r]Revised. NA Not available.
[1]Less than 1/2 unit.

HAITI

A 2.8% real growth in the GNP has been estimated for 1980. The balance of trade deficit was expected to decrease due to a substantial increase in coffee exports, the primary source of foreign exchange. Bauxite remained the only significant mineral export with volumes holding fairly steady during recent years, although production is expected to decline by about 37% in 1981.

In May 1980, Haiti received a blow to its future economic planning when Reynolds Metals, Inc., announced it would cease bauxite mining at Miragoâne. Reynolds cited large stockpiles in the United States and declining profitability of the Haitian mines as reasons for terminating their operation. After discussions were held with the Government, Reynolds agreed to continue mining as long as it was economically feasible, but with a possibility of closing in 1982. This would forestall the effects of an immediate loss of foreign exchange earnings and Government revenue. Bauxite exports were valued at almost $18 million in 1980 and accounted for 8.7% of total exports. A press release revealed that Reynolds' "obliga-

tions" had decreased owing to the low quality of extracted bauxite. This statement implies that Reynolds negotiated an agreement that would result in lower revenues for Haiti, but even so, it should certainly be more satisfactory than the sudden cessation of this small but important budgetary contribution. Reynolds has been criticized in the press for its failure to provide an adequate soil rehabilitation and reforestation program.

Anschutz began seismic surveys on its offshore and onshore concessions and planned to drill a wildcat well on the Plateau Centrale concession during 1981. This Anschutz concession is across the border from the Canadian Superior concession in the Dominican Republic where a well is also scheduled to be drilled in 1981.

Late in 1980, it was reported that Haiti will participate in the Mexico-Venezuela crude oil financing facility that these two countries have jointly made available to Caribbean and Central American Governments. A complicating factor is that Haiti does not have a petroleum refinery. Since this financing arrangement involves only crude oil, not petroleum products, Haiti must make arrangements for refining and transportation. Haiti has traditionally obtained its petroleum product needs from the Shell Oil Co. refinery on Curaçao. In 1980, Haiti's petroleum import bill was $51 million and represented 16% of total import costs.

Table 9.—Haiti: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
Aluminum: Bauxite	700,707	629,524	629,524	
Cement	r89,884	61,330	--	Ecuador 16,338; French Guiana 13,455; Montserrat 5,568.
Iron and steel scrap	1,155	599	--	Colombia 470; West Germany 103.

rRevised.
[1]Data for years ending Sept. 30 of that stated.

Table 10.—Haiti: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	r322	201	56	Austria 73; West Germany 33; Belgium 29.
Copper metal including alloys, all forms	48	21	10	Japan 6; United Kingdom 3.
Iron and steel:				
Ore and concentrate	r54	340	321	Bulgaria 10; Jamaica 9.
Metal:				
Scrap, kilograms	18,229	1,146	876	Bahamas 270.
Semimanufactures[2], kilograms	r11,312	17,169	2,446	Sweden 5,247; Japan 4,352; Belgium 1,866.
Lead:				
Ore and concentrate	5	3	2	United Kingdom 1.
Metal including alloys, all forms	5	5	5	
Nickel metal including alloys, all forms, kilograms	267	--		
Platinum-group metals including alloys, all forms, troy ounces	643	225	193	Austria 32.
Silver metal including alloys, all forms, do	64	1,190	--	All from Hong Kong.
Tin metal including alloys, all forms	504	514	411	France 103.
Zinc metal including alloys, all forms, kilograms	945	882	882	

See footnotes at end of table.

Table 10.—Haiti: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS —Continued				
Other base metals including alloys, all forms kilograms	1	19	19	
NONMETALS				
Abrasives: Grinding and polishing wheels and stones and other abrasives including industrial diamond	4	3	1	Brazil 1; West Germany 1.
Asbestos, crude	3	6	2	Canada 4.
Cement	2,049	1,144	8	Belgium 282; Denmark 275; Japan 193; United Kingdom 190.
Clays and clay products:				
Crude	132	79	71	Mexico 5; Netherlands 2.
Products, refractory and nonrefractory	1,061	1,014	233	Italy 259; Spain 218; Dominican Republic 108.
Fertilizer materials:				
Crude:				
Phosphatic	14	1	1	
Potassic	58	829	7	Dominican Republic 798; France 15.
Manufactured, nitrogenous	(3)	6	6	
Graphite, natural kilograms	1	--		
Mica, worked and unworked, including splittings and waste	8	10	7	Brazil 3.
Pigments, mineral, natural	194	222	98	West Germany 86; Canada 16.
Salt	312	155	144	France 10.
Stone, sand and gravel:				
Stone:				
Dimension, worked and partly worked	206	97	2	Italy 95.
Industrial except dimension	3,522	26	9	Dominican Republic 10; West Germany 7.
Limestone except dimension	7	6	6	
Sand and gravel including crushed quartz	186	195	29	Mexico 145; Netherlands 21.
Other:				
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetals, n.e.s	143	408	234	France 72; Belgium 68; Colombia 34.
Worked and unworked, n.e.s. kilograms	527	956	819	Italy 99; Canada 22.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt, natural	2,403	3,988	295	Netherlands Antilles 3,025; Jamaica 655.
Coke agglomerates of coal, coke, lignite, peat	24	31	1	Spain 20; Belgium 10.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	113	134	--	Netherlands Antilles 129; Jamaica 5.
Kerosine do	11	17	(3)	Netherlands Antilles 16.
Distillate fuel oil do	1,035	992	4	Netherlands Antilles 909; Jamaica 78.
Lubricants do	16	17	4	Netherlands Antilles 10; Jamaica 2.
Other:				
Liquefied petroleum gas do	22	26	3	Dominican Republic 17; Panama 5.
Mineral waxes do	2	3	2	West Germany 1.
Bituminous mixtures, n.e.s do	13	5	(3)	Netherlands Antilles 4; Jamaica 1.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2	6	5	United Kingdom 1.

r Revised.
[1] Data are for years ending Sept. 30 of that stated.
[2] Includes small quantities of pig iron, ferroalloys, and crude steel.
[3] Less than 1/2 unit.

JAMAICA

In 1980, GDP declined 3.5%, representing the sixth consecutive year that Jamaica has failed to register any overall economic growth. Severe foreign exchange shortages persisted throughout the year, although import levels were reduced to bare necessities. These import restrictions resulted in widespread plant closings due to a lack of raw materials and spare parts. This increased unemployment to almost 31% during 1980. The rate of inflation was expected to average 28% for the year.

The rising cost of petroleum imports has certainly played a major part in Jamaica's

financial difficulties. The Government initiated mandatory energy conservation measures and indicated it would seek agreements to participate in the Mexico-Venezuela crude oil financing facility as well as the petroleum products financing mechanism sponsored by Trinidad and Tobago.

In the last quarter of 1980, a change in Government leadership also brought a shift in Government policy. This, in turn, created a receptive attitude on the part of international lenders who became more amenable to granting loans and reopening lines of credit.

One of Jamaica's problems has been that although the Government maintained that it welcomed foreign investors and continued to negotiate for projects involving foreign companies, there remained a certain skepticism on the part of investors as to their ultimate intentions. Government-initiated statements on socialistic commitments and economic independence combined with rhetoric against capitalism and international imperialism resulted in a flight of local capital and caused potential foreign investors to seek a friendlier atmosphere elsewhere. The Government has now begun an intense program of reestablishing investor confidence in Jamaica's stability and receptiveness to foreign involvement in its development projects.

The bauxite industry appeared to have responded positively to the bauxite levy decrease and production incentives established in 1979. Bauxite and alumina production increased Jamaica's share of earnings to $209 million in 1980. Bauxite production increased to the highest level since 1974 and alumina production also increased substantially. A slightly lower quantity of bauxite, almost 6.2 million tons, was available for export to the United States in 1980 due to increased domestic alumina production. Lower exports also reflected reduced requirements for Jamaican bauxite on the part of the U.S. consumers.

The increased production, which evidently stemmed from the 1979 reduced bauxite levy, led to speculation that the Government might be persuaded to make further adjustments as an inducement for increasing utilization of, or expanding, current alumina capacity. The Government has not yet indicated what action, if any, it will take on this sensitive issue.

The Alumina Partners of Jamaica (Alpart) announced a development program designed to increase efficiency and competitiveness and expand capacity to 1.3 million tons by 1983. In 1980, Alpart's alumina output increased 23% over that of 1979, nearing the present 1.2-million-ton production capacity.

At Jalmacan, 93% owned by Alcan Jamaica, Ltd., 1980 alumina output increased 9% above that of 1979 and production approached the 1.1 million-ton plant capacity. At Alcoa Minerals of Jamaica, where alumina capacity at 550,000 tons is the lowest of the three producers, production dropped slightly in 1980. With strong Government approval and participation, negotiations were underway to expand alumina production capacity to 1.1 million tons per year. The feasibility studies for this $360 million expansion are expected to be completed by late 1981. Interest in the expansion may be divided between Alcoa, the Jamaican Government, and three Norweigian firms, Elkem, Norsk Hydro, and Ardal og Sunndal Verk. Negotiations involve project costs, financing, and the production levy.

The ultimate decision for the Government's planned $600 million South Manchester alumina refinery remained uncertain at the end of 1980. Questions arose as to whether increased capacity at existing facilities would be a more practical solution towards expanding alumina exports.

In 1980, Revere Copper and Brass Inc. lost its last bid to vacate part of the arbitration panel's award in its claim against the Overseas Private Investment Corp. (OPIC). In June 1980, Revere accepted the $1.18 million from OPIC for the award and related expenses.

Fuel conservation, development of alternative energy sources, and exploration for domestic petroleum reserves form the bulwark of Jamaica's struggle to escape the devastating impact of soaring energy costs. About 48% of total oil imports are purchased, paid for, and consumed by the energy-intensive bauxite-alumina industry, but the remaining costs must be met by Jamaica's hard-pressed economy. The Jamaica Public Service Co. and the cement plant, both State-owned, consume an estimated 40% of Jamaica's nonbauxite oriented oil imports. The Government was studying the substitution of imported coal as an alternative and possibly cheaper fuel for electricity and cement production. The cost of converting the Nation's electrical plants may be a deterring factor until

Jamaica's economic revival.

The State-owned Petroleum Corp. of Jamaica (PCJ) has negotiated offshore petroleum exploration agreements with foreign companies. A consortium composed of Union Texas Petroleum Corp. and Azienda General Italiani Petroli S.p.A. (AGIP), a subsidiary of Ente Nazionale Idrocarburi (ENI), the Italian State oil company, planned to drill offshore in the Pedro Banks area in 1981. PCJ continued shallow testing onshore areas during 1980 and received a $23.5 million Inter-American Development Bank (IDB) loan to begin drilling in 1981. This loan marks the first time the IDB has extended a loan for petroleum exploration.

Table 11.—Jamaica: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate thousand tons	6,448	6,469	6,469	
Alumina do	2,320	2,061	665	United Kingdom 500; Norway 235; Spain 222; Canada 188.
Aluminum sulfate	9,615	10,254	--	Dominican Republic 3,264; Panama 2,500; Trinidad and Tobago 1,483.
Metal including alloys:				
Scrap	22,817	357	343	United Kingdom 14.
Unwrought	--	12	12	
Semimanufactures	656	3,355	--	Trinidad and Tobago 3,254; Guadeloupe 30.
Copper metal including alloys, scrap	168	75	16	West Germany 59.
Gold:				
Waste and sweepings value	$14,632	$38,328	$651	Bahamas $21,427; Canada $8,538; Barbados $7,534.
Metal, unwrought or partly wrought do	$18	$48	$48	
Iron and steel metal including alloys:				
Scrap	199	123	--	All to United Kingdom.
Semimanufactures:				
Bars, rods, angles, shapes, sections	[1]234	72,932	--	Trinidad and Tobago 48,929; Cuba 24,000.
Universals, plates, sheets	5,082	5,714	--	Trinidad and Tobago 4,148; Barbados 369; St. Lucia 338.
Hoop and strip	1	--		
Wire	21	--		
Tubes, pipes, fittings	817	1,391	123	Trinidad and Tobago 1,123; Barbados 85; Dominica 34.
Castings and forgings, rough	--	14	1	Trinidad and Tobago 13.
Lead:				
Oxides	--	18	18	
Metal including alloys:				
Scrap	125	--		
Unwrought and semimanufactures	--	4	--	All to Trinidad and Tobago.
Platinum-group metals including alloys, unwrought or partly wrought value	$834	--		
Silver:				
Waste and sweepings do	--	$32,777	$10,847	Barbados $10,035; Bermuda $6,649; Bahamas $5,245.
Metal including alloys, unwrought or partly wrought troy ounces	4,437	5,723	3,022	Cayman Islands 1,447; Bermuda 1,029; Saudi Arabia 129.
Tin metal including alloys:				
Scrap	472	302	302	
Unwrought and semimanufactures	216	279	279	
Zinc metal including alloys, scrap	45	34	--	All to United Kingdom.
Other: Oxides of chromium, cobalt, manganese	--	15	--	All to Barbados.
NONMETALS				
Cement	539	3,425	--	Trinidad and Tobago 1,708; Cayman Islands 1,611.
Chalk value	--	$543	--	All to Cayman Islands.
Clays and clay products:				
Crude	5	--		
Products:				
Refractory (including nonclay brick)	1	--		
Nonrefractory value	[r]$2,778	$6,794	$112	Cayman Islands $5,316; Guyana $1,366.
Fertilizer materials, manufactured, nitrogenous	218	--		
Gypsum and plasters	152,816	21,062	13,442	Venezuela 5,017; Haiti 2,405; Trinidad and Tobago 194.
Lime	479	1,813	--	Trinidad and Tobago 1,707; Barbados 106.
Salt	3,301	554,531	--	Trinidad and Tobago 288,985; Barbados 253,951; Grenada 11,428.

See footnotes at end of table.

Table 11.—Jamaica: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s.:				
Soda ash	15	445	--	Haiti 300; Dominican Republic 145.
Caustic soda	300	--		
Stone, sand and gravel:				
Dimension stone, crude and worked	21	[2]315	--	Cayman Islands 250; Bermuda 47.
Gravel and crushed rock	2	4	--	All to Cayman Islands.
Sand excluding metal-bearing	1,016	--		
Sulfur: Sulfuric acid	150	188	--	Trinidad and Tobago 165; Haiti 21; Cayman Islands 2.
Other, kilograms	--	705	600	France 105.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	209	--	All to St. Vincent.
Hydrogen, helium, rare gases	15	1	--	All to Cayman Islands.
Petroleum:				
Crude and partly refined, 42-gallon barrels	6	780	--	Cuba 767; Denmark 13.
Refinery products:				
Gasoline:				
Aviation, do	--	32,952	--	Bahamas 572; Cayman Islands 403; Guyana 321.
Motor, do	20,530	158,893	--	Bahamas 101,052; Netherlands Antilles 36,914; Cayman Islands 14,611.
Kerosine and jet fuel, do	55,440	113,959	428	Surinam 113,531.
Distillate fuel oil, do	213,383	296,816	5,906	Panama 121,085; Bahamas 90,611; United Kingdom 22,291.
Residual fuel oil including bunkers, do	--	533,803	--	Netherlands Antilles 404,019; Barbados 97,026.
Lubricants, do	207,976	166,024	28	Panama 24,590; Guyana 18,549; Surinam 16,327.
Mineral wax, do	--	2	2	
Other:				
Liquefied petroleum gas, do	--	3	--	All to Turks and Caicos Islands.
Nonlubricating oils, n.e.s., do	([3])	--		
Pitch and asphalt, do	16,429	22,592	--	Cayman Islands 8,884; Haiti 5,660; Bahamas 2,151.
Total, do	513,758	1,325,044		

[r]Revised.
[1]Excludes quantity valued at $1,348.
[2]Excludes quantity exported to Canada valued at $986.
[3]Less than 1/2 unit.

Table 12.—Jamaica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide	33	18	17	United Kingdom 1.
Metal including alloys:				
Unwrought	1,724	50,615	--	All from Canada.
Semimanufactures	2,751	2,136	1,473	United Kingdom 404; West Germany 84; Switzerland 35.
Copper:				
Copper sulfate	46	6	6	
Metal including alloys:				
Scrap, value	--	$596	$533	United Kingdom $63.
Unwrought	4	8	8	
Semimanufactures	791	6,222	68	United Kingdom 6,086; Spain 28; Hong Kong 26.

See footnotes at end of table.

Table 12.—Jamaica: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Gold:				
Waste and sweepings ---value	$3,728	$10,221	--	Canada $10,176; United Kingdom $45.
Rolled on base metal ---troy ounces	--	257	--	West Germany 193; Canada 64.
Unwrought or partly wrought ---do	9,195	6,623	643	Canada 4,662; United Kingdom 1,318.
Iron and steel metal:				
Scrap---value	--	$562	--	All from United Kingdom.
Pig iron, cast iron, ferroalloys, similar materials	278	[1]226	81	United Kingdom 100; Canada 28; Cuba 17.
Steel, primary forms	3,459	12,986	12,727	United Kingdom 217; West Germany 42.
Semimanufactures:				
Bars, rods, angles, shapes, sections	10,259	11,685	3,560	United Kingdom 3,153; Canada 2,011; Brazil 684.
Universals, plates, sheets	24,162	23,644	2,516	Japan 14,545; United Kingdom 4,531.
Hoop and strip	4,090	379	170	Australia 157; United Kingdom 46; West Germany 6.
Rails and accessories	2,269	217	217	
Wire	5,509	77,335	74,171	United Kingdom 1,203; Belgium-Luxembourg 689; Japan 386.
Tubes, pipes, fittings	6,685	18,136	13,369	France 2,665; United Kingdom 1,574.
Castings and forgings, rough	79	117	69	Barbados 25; United Kingdom 11.
Lead:				
Oxides	NA	40	26	Mexico 10; United Kingdom 3; West Germany 1.
Metal including alloys:				
Scrap	38	52	--	United Kingdom 33; Mexico 18; Cuba 1.
Unwrought	54	20	--	All from United Kingdom.
Semimanufactures	191	26	20	Canada 4; United Kingdom 2.
Magnesium metal including alloys, all forms	5	--		
Manganese ore and concentrate	303	139	--	Belgium-Luxembourg 72; United Kingdom 62.
Molybdenum metal including alloys, unwrought ---kilograms	NA	1	--	All from United Kingdom.
Nickel metal including alloys:				
Unwrought ---value	--	$71	$71	
Semimanufactures	11	13	8	United Kingdom 3; Canada 2.
Platinum-group metals:				
Ores and concentrates	1	--		
Metals including alloys, unwrought or partly wrought---troy ounces	804	2,636	2,604	United Kingdom 32.
Silver:				
Ore and concentrate---value	--	$449	--	All from West Germany.
Waste and sweepings ---do	--	$1,981	$31	Canada $1,950.
Unwrought or partly wrought troy ounces	85,810	166,927	5,755	Canada 92,916; United Kingdom 68,256.
Tin metal including alloys:				
Scrap	1	4	--	All from United Kingdom.
Unwrought	2	105	--	Denmark 103; United Kingdom 2.
Semimanufactures	10,562	11,081	4,793	United Kingdom 6,190; Japan 98.
Titanium oxide	NA	201	111	West Germany 54; United Kingdom 36.
Uranium and thorium metals including alloys, all forms ---kilograms	1,360	12	12	
Zinc:				
Oxide and peroxide	NA	80	22	United Kingdom 30; Mexico 10; Spain 10.
Metal including alloys:				
Scrap	99	49	--	All from Canada.
Unwrought	1,269	1,210	--	Canada 1,107; Mexico 103.
Blue powder	4	11	--	All from United Kingdom.
Semimanufactures	83	199	(2)	Canada 160; Barbados 36; United Kingdom 3.
Other:				
Ores and concentrates, n.e.s	50	2,661	1	United Kingdom 2,660.
Oxides of chromium, cobalt, manganese ---kilograms	NA	544	21	United Kingdom 473; West Germany 50.
Ash and residue containing nonferrous metals	--	33	33	
NONMETALS				
Abrasives, natural:				
Pumice, emery, natural corundum, etc	60	7	3	Italy 3; United Kingdom 1.
Dust and powder of precious and semiprecious stones---value	$15	--		
Grinding and polishing wheels and stones ---do	$88,645	$149,952	$40,814	Switzerland $63,893; United Kingdom $21,888; Italy $11,879.
Asbestos	352	370	21	Botswana 230; Canada 100.
Barite, natural	25	--		

See footnotes at end of table.

Table 12.—Jamaica: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Boron, crude, natural	--	3	3	
Cement	946	5,985	117	Cuba 5,451; Denmark 220; United Kingdom 106.
Chalk	12	13	--	All from West Germany.
Clays and clay products:				
Crude	783	447	418	Mexico 23; United Kingdom 5; Canada 1.
Products:				
Refractory (including nonclay brick)	4,094	40,311	39,779	United Kingdom 439; Canada 71.
Nonrefractory value	$187,437	$884,790	$49,486	Cuba $587,752; United Kingdom $240,738.
Cryolite and chiolite	--	100	--	All from Canada.
Diamond:				
Gem, worked or unworked value	$41,445	--		
Industrial[1] do	$671	--		
Diatomite and other infusorial earth	4,599	1,005	1,005	
Feldspar, fluorspar, leucite, nepheline	NA	3	3	
Fertilizer materials:				
Crude:				
Nitrogenous	1	--		
Phosphatic	2	1,016	--	All from United Kingdom.
Manufactured:				
Nitrogenous	25,714	28,644	6,510	Trinidad and Tobago 22,074.
Phosphatic	12,042	13,799	5,083	Netherlands 7,251; Netherlands Antilles 1,011.
Potassic	5,722	8,780	8,780	
Other including mixed	1,366	1,508	1,504	West Germany 4.
Ammonia	226	261	155	United Kingdom 80; West Germany 16.
Graphite, natural	--	16	16	
Gypsum and plasters	130	[3]509	509	
Lime	18	18	--	All from Cuba.
Magnesite, crude	11	1	(2)	United Kingdom 1.
Mica:				
Crude including splittings and waste	138	89	2	Norway 85; Belgium-Luxembourg 2.
Worked including agglomerated splittings kilograms	199	344	343	United Kingdom 1.
Pigments, mineral:				
Natural, crude	19	10	--	United Kingdom 7; West Germany 3.
Iron oxides, processed	NA	7	(2)	West Germany 5; United Kingdom 2.
Precious and semiprecious stones except diamond value	$11,765	$46,126	$13,683	West Germany $18,888; United Kingdom $8,041; Switzerland $5,514.
Salt	9,309	27,904	22,534	Netherlands Antilles 5,352; Canada 16; United Kingdom 2.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	291,804	301,830	301,379	Belgium-Luxembourg 181; France 158.
Caustic potash	--	26	3	Sweden 20; United Kingdom 2.
Soda ash	4,946	--		
Stone, sand and gravel:				
Dimension stone, crude and worked	28	10,045	21	Canada 7,738; Italy 1,880.
Gravel and crushed rock	235	64	14	Italy 50.
Limestone except dimension	28	(4)	--	All from Canada.
Quartz, unground	20	--		
Sand including ground quartz	569	230	223	United Kingdom 7.
Sulfur:				
Elemental, all forms	10,818	5,825	5,824	United Kingdom 1.
Sulfur dioxide kilograms	114,406	41	41	
Sulfuric acid including oleum	22	1,306	1,230	Canada 61; West Germany 12; United Kingdom 3.
Talc, steatite, soapstone, pyrophyllite	431	18,482	18,414	United Kingdom 28; Norway 20.
Other:				
Crude	46	2,661	1	United Kingdom 2,660.
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetals, n.e.s.	222	337	299	United Kingdom 28.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	40	201	15	Cuba 186.
Carbon black	5	1,186	59	Mexico 861; Colombia 243; Canada 20; United Kingdom 1.
Coal including briquets:				
Anthracite and bituminous coal	20	--		
Briquets of anthracite and bituminous coal	1	5	--	All from United Kingdom.
Coke and semicoke	446	118	--	West Germany 107; United Kingdom 11.
Hydrogen, helium, rare gases	35	58	55	United Kingdom 2; Canada 1.
Peat including briquets and litter	10	--		

See footnotes at end of table.

Table 12.—Jamaica: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	6,974	8,353	230	Venezuela 8,048; Netherlands Antilles 75.
Refinery products:				
Gasoline:				
Aviation do	17	310	--	All from Netherlands Antilles.
Motor do	574	1,056	1	Netherlands Antilles 1,054.
Kerosine and jet fuel do	92	828	8	Netherlands Antilles 820.
Distillate fuel oil do	78	277	1	Netherlands Antilles 276.
Residual fuel oil including bunkers do	5,981	10,037	--	Netherlands Antilles 6,530; Venezuela 2,048; Trinidad and Tobago 1,338.
Lubricants do	59	301	79	Netherlands Antilles 208; Trinidad and Tobago 10.
Mineral jelly and wax do	15	12	3	United Kingdom 3; Japan 2; West Germany 2.
Other:				
Liquefied petroleum gas do	257	228	(2)	Venezuela 227.
Nonlubricating oils, n.e.s. do	531	20	(2)	Netherlands Antilles 20.
Asphalt, bitumen, pitch, pitch coke do	10	2	2	
Total do	7,614	13,071		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	121	22	19	United Kingdom 2.

NA Not available.
[1]Excludes quantity valued at $2,399.
[2]Less than 1/2 unit.
[3]Excludes quantity valued at $468.
[4]Value only reported at $454.

MARTINIQUE AND GUADELOUPE

The two cement plants, one operating on Martinique and the other on Guadeloupe, were each reported as having a 1979-80 annual capacity of 250,000 tons. It was unclear as to whether this increase in capacity from 180,000 tons was due to expansions of existing facilities or new construction. Otherwise, there has been no known changes in the status of the small rock-quarrying industries located on the two islands.

NETHERLANDS ANTILLES

The two island groups known collectively as the Netherlands Antilles are an autonomous part of the Kingdom of the Netherlands. The largest islands are in the Aruba, Bonaire, and Curaçao group where 92% of the Federation's population reside. The smaller islands, St. Eustatius, Saba, and St. Maarten, are located toward the northern end of the Lesser Antilles chain. Independence is not anticipated until 1990, after problems relating to the exact form of the future Government have been discussed and resolved.

Major foundations of the Netherlands Antilles economy are the refining of imported oil and petrochemicals. These industries represent the majority of foreign investment and account for over 85% of export earnings. The growing use of established free trade zones as a base of operation for foreign companies may help offset losses to the economy from reduced refinery production.

The two large refineries located on Aruba and Curaçao have not fared well the last few years, suffering from a loss of markets and comparatively older and less efficient plants. Capacity utilization has fallen to about 60%. The decreased performance of the refineries has been reflected in a growing unemployment rate that appears to be greater on Curaçao. As a whole, unemploy-

ment averaged about 22% of the labor force, attributed to a rising population and the gradual drop in refinery employment over the years from 20,000 to about 4,000. Other employment opportunities have not been available to absorb this excess labor.

The proposed legislation to regulate petroleum exploration in Aruba, Bonaire, and Curaçao was closer to resolution in 1980. Dissention came from Aruba which objected to any division of proceeds with the other islands through the Central Government. The proposed regulations called for a 75:25 split with the other islands. There already exists a Saba Bank Act which covers that area and under which exploration concessions have been granted.

Successful drilling offshore Venezuela has spurred exploration interest in the Netherlands Antilles, especially Aruba. The delay in passing the necessary legislation has deferred the awarding of concessions on Aruba. It was reported that unless a resolution can be found, legislation may be passed excluding Aruba. British Petroleum Corp. has obtained exploration rights for an area southeast of Curaçao.

TRINIDAD AND TOBAGO

Trinidad and Tobago has continued to maintain substantial economic growth, although the real growth rate has shown a steady decline from the over 11% registered in 1976. In 1980, the GDP grew in real terms by 5%. At current prices the GDP was estimated at substantially over $4 billion in 1980. Economic growth has been slackening owing to an overall decline in petroleum-related activities, to which in 1980 was added a poor performance in the agricultural sector and some stagnation in manufacturing. Current revenues from taxes on the petroleum sector increased to over $1 billion in 1979, equalling over 60% of total Government revenues. This sector also accounted for one-half of the GDP and about 90% of total export earnings. A strong balance-of-payments surplus has been maintained and foreign exchange reserves are high owing to the rise in international oil prices.

A heavy dependence on imported goods combined with wages increasing faster than productivity has increased the rate of inflation. The inflation rate was over 10% in 1978, reached almost 15% in 1979, and by mid-1980 averaged about 18%.

In July 1980, in recognition of the serious financial difficulties confronting oil-importing countries, in general, and the member states of the Caribbean Community (CARICOM), in particular, the Government of Trinidad and Tobago announced its intention to establish an aid mechanism for the benefit of eligible member countries of CARICOM to provide against the price increases of petroleum products, fertilizers, and asphalt.

To be eligible, participants must qualify for financial assistance from Trinidad and Tobago under the general guidelines by which the Caribbean Aid Council operates. The facility limits financing for incremental costs relative only to price changes of petroleum products, fertilizers, and asphalts since January 1, 1979. The effective date of the facility was established January 1, 1980, with an initial life span of 3 years. Continuation of the facility and further commitments would depend on a reexamination of the events in the international market, experiences with the present facility, and the economic strength of Trinidad and Tobago.

The present facility is not to exceed a total of $209 million over the 3-year period. There are two formats to cover the loans and the one applied is dependent on the economic development of the receiver country. Both loan schedules have a 15-year maturity and a 3-year grace period. The rate of interest for the more developed countries (such as Barbados, Guyana, and Jamaica) would be 3% with interest capitalized during the grace period. Those classified as less developed countries would pay 2%, with interest capitalized during the grace period. Borrowers will be permitted to service their debt by the supply of commodities to Trinidad and Tobago with the value of such shipments to be estimated at prevailing market prices.

By October, the complicated procedural arrangements had been approved. Trinidad and Tobago expected the facility would require an allocation of about 25,000 barrels of oil per day, amounting to about 12% of its

crude oil production.

The year ended without passage of the petroleum tax legislation that had been proposed at the end of 1979. However, it was announced that new legislation was being drafted that would probably be retroactive to January 1, 1980. According to the Government announcement, the new tax legislation would concern all companies active in Trinidad and Tobago and affect production taxation, accelerated depreciation eligibility, capital expenditure deductions, exploration deductions, and refining operations.

COMMODITY REVIEW

Metals.—*Aluminum.*—During 1980, Trinidad and Tobago resumed negotiations with Jamaica for the supply of 150,000 to 200,000 tons per year of alumina for the gas-fueled aluminum plant proposed for construction at Port Lisas. The alumina was to come from the proposed Jamaican South Manchester alumina project, which still remained in an uncertain status at yearend.

Iron and Steel.—The Iron and Steel Co. of Trinidad and Tobago (Iscott) brought its first Midrex direct-reduction, 400,000-ton-per-year-capacity plant into commercial production in September 1980. This capacity will be doubled in 1982 when the second plant, now under construction, comes onstream. Feasibility studies for greater sponge iron capacity have been taken under consideration by Trinidad and Tobago and could involve AMAX Corp. as a partner.

The steel-making furnaces were reported as starting up in December 1980, although this may be a premature report. The melt-cast shop consists of two electric arc furnaces and two continuous-casters with an eventual annual capacity of 600,000 tons of steel billets. The wire rod mill, with an annual capacity of 465,000 tons, fell behind the construction schedule and was expected to come onstream early in 1981.

In late 1980, it was reported that Dansteel, a Trinidadian producer of wire products, was considering the construction of a rerolling plant for completion around the middle of 1982. The projected plant would be a 9-strand, continuous-merchant bar mill. Steel billets would be supplied by Iscott. Initial capacity was expected to be 90,000 tons per year with an eventual capacity of 240,000 tons per year, depending on market conditions. The rerolling plant would be operated by an Italian firm identified as Danieli, under a 2-year contract. Dansteel also revealed that they plan to install a 25,000-ton-per-year wire drawing and galvanizing plant that would come onstream in mid-1981. This plant would use wire rod from the mill that Iscott has under construction.

Nonmetals.—*Fertilizer Materials.*— Trinidad and Tobago's capacity for upgrading ammonia consists of a synthetic ammonium sulfate plant and a urea unit owned by W. R. Grace & Co. through its subsidiary Federation Chemicals. In 1977, the Trinidad and Tobago Nitrogen Co. Ltd. anhydrous ammonia plant came onstream with a capacity of 400,000 tons per year (296,000 tons per year nitrogen), and ammonia exports more than doubled in 1978. Fertilizers of Trinidad and Tobago, Ltd. (Fertrin), will bring its two new plants onstream during the first half of 1981, bringing ammonia production capacity at Point Lisas to over 1 million tons per year of nitrogen, mostly destined for export due to Trinidad and Tobago's limited domestic markets.

In 1980, approval was expected for the construction of a $155 million granular urea plant at Point Lisas. Planned capacity was 1,620 tons per day. It was reported that Agrico Chemical Co. of the United States will hold a 49% interest and the Government will have the majority interest. When operating at full capacity, perhaps by 1984, the urea plant will absorb the entire output from one of Fertrin's two ammonia plants, reducing ammonia export potential to about 700,000 tons per year. Urea production from the new plant, less domestic requirements, will mostly be exported to the United States and smaller amounts may be sold in Latin America.

Mineral Fuels.—*Natural Gas and Petroleum.*—A decision whether to proceed with a liquefied natural gas (LNG) plant will probably be made in 1981. If approved, the projected completion date would be in 1985. Recent increases in the international gas prices have made the project more feasible.

Wasteful flaring of natural gas remains of utmost concern to the Government. The iron and steel plant that began production in late 1980 and the fertilizer plants projected to come onstream in 1981 will consume some gas production. The delay in approval for the construction of the proposed LNG facility will prevent full gas utilization in the near future.

Based on the first 6 months of 1980, crude oil production at about 213,900 barrels per

day fell below the comparative period in 1979. Natural gas production increased from 465 million cubic feet per day in 1979 to over 500 million cubic feet per day in 1980. The average daily crude oil production by company is shown in the following table and is based on production during the first half of the year.

Company	1979	Percent of production	1980	Percent of production
Amoco Trinidad Oil Co. Ltd	120,000	56	121,100	56
Trinidad Northern Areas, Ltd	43,800	20	40,400	19
Trinidad and Tobago Oil Co., Ltd	9,400	4	18,900	9
Texaco-Trinidad, Inc	26,300	13	16,800	8
Trinidad Tesoro Petroleum Corp	15,700	7	16,700	8
Total	215,200	100	213,900	100

There was some successful drilling in offshore areas east of Galeota Point during 1980. Texaco-Trinidad, Inc., Mobil Oil Co., and Trinidad and Tobago Oil Co., Ltd. have planned exploratory drilling in the Gulf of Paria. It was announced that a new state oil company would be formed for the purpose of initiating deep-water exploration. Lacking expertise for this type of drilling, the company at first will take a minority interest in ventures with more experienced foreign companies.

[1]Physical scientist, Branch of Foreign Data.

Table 13.—Trinidad and Tobago: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	46	4	NA	NA.
Copper metal including alloys, all forms	3,173	541	58	West Germany 163; United Kingdom 158.
Iron and steel metal:				
Scrap	1,822	1,001	NA	NA.
Steel, primary forms	132	1	NA	NA.
Semimanufactures	2,951	5,468	4,395	NA.
Lead:				
Ore and concentrate	96	60	NA	NA.
Oxide	142	3	NA	NA.
Metal including alloys, all forms kilograms	36	NA	NA	NA.
Molybdenum metal including alloys, all forms	--	24	NA	NA.
Platinum-group metals including alloys, waste and sweepings value	$11,083	--		
Silver metal including alloys, all forms troy ounces	99,957	--		
Tin metal including alloys, all forms kilograms	10	NA	NA	NA.
Zinc metal including alloys, all forms	71	11	NA	NA.
Other:				
Oxides, n.e.s kilograms	NA	726	NA	NA.
Base metals including alloys, all forms, n.e.s do	29	--		
NONMETALS				
Abrasives: Grinding and polishing wheels and stones do	560	195	NA	NA.
Asbestos value	--	$266	NA	NA.
Barite	1,469	527	NA	NA.
Cement	29	16	NA	NA.
Chalk	3	7	NA	NA.
Clays and clay products:				
Crude	131	40	NA	NA.
Products:				
Refractory (including nonclay brick)	11	39	NA	NA.
Nonrefractory value	$12,392	$30,025	NA	Grenada $7,376.
Diamond, gem, not set or strung carats	58	2	2	

See footnotes at end of table.

Table 13.—Trinidad and Tobago: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude, phosphatic	--	5	NA	NA.
Manufactured:				
Nitrogenous	117,453	100,994	32,281	Guyana 21,354; Jamaica 18,035; Barbados 1,735.
Potassic	NA	549	NA	NA.
Other including mixed	62	9	NA	NA.
Ammonia	402,387	394,678	273,433	United Kingdom 40,232.
Gypsum	1	--		
Lime	116	NA	NA	NA.
Mica, all forms	4	2	NA	NA.
Salt	207	25	NA	NA.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	20	26	NA	NA.
Soda ash	NA	6	NA	Barbados 2.
Stone, sand and gravel:				
Dimension stone:				
Crude	70	NA	NA	NA.
Worked	1	1	--	All to Grenada.
Gravel and crushed rock	1	NA	NA	NA.
Quartz	2	--		
Sand excluding metal-bearing	17	20	NA	NA.
Sulfuric acid including oleum	99	13	NA	Guyana 9.
Talc	4	3	NA	NA.
Other:				
Crude	--	2	NA	NA.
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetal, n.e.s	7	1,167	NA	Guyana 904; Grenada 46.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,589	9,823	NA	United Kingdom 850.
Coal:				
Anthracite and other value	--	$229	NA	NA.
Hydrogen, helium, rare gases	3	7	NA	NA.
Lignite	1	--		
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	58,969	54,282	51,908	Netherlands 276.
Refinery products:[1]				
Gasoline, motor and aviation do	8,806	8,570	2,021	United Kingdom 492; Guyana 206; Suriname 171.
Kerosine do	3,764	1,598	365	Guadeloupe 78; Guyana 49; Barbados 30.
Jet fuel do	1,883	2,624	NA	Barbados 168; Bahamas 31.
Distillate fuel oil do	9,030	10,452	404	Netherlands 1,261; Guyana 284; Suriname 189.
Residual fuel oil do	46,791	41,288	15,986	Suriname 2,580; Guyana 1,431; Netherlands 307.
Lubricants do	526	404	20	Jamaica 8.
Other:				
Liquefied petroleum gas do	262	389	NA	Panama 119; Guyana 44; Barbados 44.
Mineral jelly and wax do	1	1	NA	NA.
Nonlubricating oils, n.e.s. do	140	93	4	Jamaica 16; Costa Rica 5.
Bitumen and other residues do	10	38	NA	Guadeloupe 17; Guyana 5.
Bituminous mixtures, n.e.s. do	6	71	NA	United Kingdom 5.
Total do	71,219	65,528		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	100,910	62,326	21,308	Netherlands 28,219; Italy 12,448; United Kingdom 253.

NA Not available.
[1]Includes bunkers.

Table 14.—Trinidad and Tobago: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite	--	76	NA	NA.
Oxide and hydroxide	308	12	2	United Kingdom 10.
Metal including alloys, all forms	2,992	2,387	429	Canada 264; United Kingdom 116.
Chromium oxides	NA	38	(1)	Belgium-Luxembourg 25; United Kingdom 3; West Germany 3.
Copper:				
Copper sulfate	40	29	2	United Kingdom 26.
Metal including alloys, all forms	687	754	69	United Kingdom 589; Canada 18.
Iron and steel metal:				
Waste and scrap	20	127	124	NA.
Pig iron, ferroalloys, similar materials	5,261	71	24	United Kingdom 29.
Steel, primary forms	10,619	8,214	7,855	Japan 359.
Semimanufactures:				
Bars, rods, angles, shapes, sections	244,239	149,287	1,420	United Kingdom 129,457; Japan 4,113; Belgium-Luxembourg 631.
Universals, plates, sheets	601,569	91,866	98	Japan 44,475; United Kingdom 28,172.
Hoop and strip	358	197	20	United Kingdom 175.
Rails and accessories	6	7	NA	United Kingdom 1.
Wire	7,318	6,082	249	United Kingdom 500.
Tubes, pipes, fittings	397,450	101,791	13,694	Japan 65,618; United Kingdom 15,232.
Castings and forgings, rough	14	--		
Total	1,250,954	349,230		
Lead:				
Oxides	333	320	NA	United Kingdom 53.
Metal including alloys, all forms	817	460	NA	Guyana 50; United Kingdom 4.
Magnesium metal including alloys, all forms	1	4	1	NA.
Nickel metal including alloys, all forms	8	6	NA	NA.
Platinum-group metals including alloys, all forms, troy ounces	2,154	3,279	NA	United Kingdom 1,125.
Silver metal including alloys, all forms, do.	92,080	81,213	NA	Canada 48,065; United Kingdom 16,075.
Tin metal including alloys, all forms	16	420	104	United Kingdom 25.
Titanium oxides	NA	185	138	United Kingdom 2.
Tungsten metal including alloys, all forms, kilograms	1,302	852	852	
Zinc:				
Oxides	NA	163	14	United Kingdom 85; West Germany 2.
Metal including alloys, all forms	1,130	429	8	Canada 164; United Kingdom 13.
Other:				
Ores and concentrates of precious metals	NA	76	NA	NA.
Oxides, n.e.s.	NA	541	166	United Kingdom 295; Netherlands 22; West Germany 20.
Metals including alloys, all forms:				
Sweepings of precious metals, value	$7,611	$25,748	NA	Canada $25,340.
Pyrophoric alloys: Ferrocerium	NA	5	5	
Base metals including alloys, all forms, n.e.s	6	20	NA	NA.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, natural corundum, etc	NA	3	1	NA.
Grinding and polishing wheels and stones	86	66	6	Venezuela 15; United Kingdom 9; Italy 3.
Dust and powder of precious and semiprecious stones, value	NA	$397	$397	
Asbestos	2	159	5	NA.
Barite and witherite, thousand tons	62	1,459	NA	Peru 635; West Germany 16.
Boron materials: Crude natural borates	1	NA	NA	NA.
Cement	100,942	133,260	1,658	France 295; United Kingdom 266.
Chalk	686	6,581	39	United Kingdom 6,315.
Clays and clay products:				
Crude	7,134	2,196	1,997	NA.
Products:				
Refractory (including nonclay brick)	1,521	1,869	1,233	United Kingdom 425.
Nonrefractory, value, thousands	$832	$1,488	$65	United Kingdom $1,179; West Germany $111.
Diamond:				
Gem, carats	2,809	10,245	10	NA.
Industrial, do.	5,000	20,000	10,000	NA.
Diatomite and other infusorial earth	32	6	NA	United Kingdom 5.
Feldspar, fluorspar, leucite	66	262	NA	United Kingdom 218.

See footnotes at end of table.

Table 14.—Trinidad and Tobago: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Crude	424	346	242	NA.
Manufactured:				
Nitrogenous	54	152	NA	NA.
Phosphatic	1,238	1,227	1,007	NA.
Potassic	5,075	1,782	NA	West Germany 1,415.
Other including mixed	524	182	73	West Germany 95; United Kingdom 14.
Ammonia	101	18,186	18,185	NA.
Graphite, natural ——value	$10	$77	NA	United Kingdom $44.
Gypsum and plasters	10,396	7,717	35	Venezuela 7,350; United Kingdom 106.
Lime	381	48,425	NA	NA.
Magnesite	NA	9	NA	NA.
Mica, all forms	205	175	5	United Kingdom 117.
Pigments, mineral: Processed iron oxides	9	62	NA	West Germany 16.
Precious and semiprecious stones except diamond, natural and manufactured ——carats	23	1,053	NA	United Kingdom 32; West Germany 5.
Pyrite, unroasted	NA	4,164	--	All from United Kingdom.
Salt	18,364	25,041	NA	United Kingdom 13,021; Jamaica 1,991.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	7,129	4,343	2,319	West Germany 217; United Kingdom 157; Canada 110.
Soda ash	NA	4,678	3,743	United Kingdom 670.
Potassium hydroxide and sodic and potassic peroxides	32	19	1	United Kingdom 16.
Stone, sand and gravel:				
Dimension stone:				
Crude	317	283	NA	NA.
Worked	1,456	183	NA	Italy 157.
Gravel and crushed rock	1,707	1,793	169	Italy 412; Venezuela 88.
Limestone except dimension	54,460	6,290	NA	Barbados 6,042; United Kingdom 210.
Quartz and quartzite	16	22	NA	NA.
Sand excluding metal-bearing	823	517	NA	NA.
Sulfur:				
Elemental	23	14,986	NA	NA.
Sulfur dioxide ——kilograms	--	1	NA	NA.
Sulfuric acid including oleum	741	1,135	2	United Kingdom 519.
Talc	609	3,642	3,342	France 74; United Kingdom 31.
Other:				
Crude	20	15	--	All from United Kingdom.
Building materials of asphalt, asbestos- and fiber-cement, unfired nonmetals, n.e.s.	1,653	2,606	1,321	Canada 333; United Kingdom 265.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	103	24	NA	NA.
Carbon black	--	123	46	NA.
Coal, all grades, including briquets	392	142	NA	United Kingdom 72.
Coke and semicoke	109	183	NA	United Kingdom 83.
Hydrogen, helium, rare gases	59	6	5	NA.
Peat including briquets and litter	57	56	NA	United Kingdom 47.
Petroleum:				
Crude and partly refined ——thousand 42-gallon barrels	56,651	42,187	NA	Saudi Arabia 31,688; Indonesia 5,892.
Refinery products:				
Gasoline ——42-gallon barrels	145	27,430	38	NA.
Kerosine and jet fuel ——do	44	NA	NA	NA.
Distillate fuel oil ——do	--	6	NA	NA.
Residual fuel oil ——do	101,392	125,299	NA	NA.
Lubricants ——do	273,903	44,451	5,814	Netherlands Antilles 11,656; United Kingdom 10,663; Jamaica 1,736.
Mineral jelly and wax ——do	6,237	3,517	705	United Kingdom 1,943; West Germany 522.
Other:				
Liquefied petroleum gas ——do	2,486	10,735	1,510	NA.
Nonlubricating oils ——do	3,102	14,834	9,347	United Kingdom 261.
Unspecified ——do	19,501	2,837	1,891	United Kingdom 739.
Total ——do	406,810	NA		
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals	54	50	(1)	United Kingdom 44.

NA Not available.
[1]Less than 1/2 unit.

The Mineral Industry of Central American Countries

By Pablo Velasco[1]

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BELIZE

The Belize economy recorded modest growth during 1980; the growth of the gross domestic product (GDP) in real terms was between 1% and 2%. At current prices, the 1980 GDP reached $108 million[2]. This output was largely attributed to the performance of a few industries, mostly nonminerals. Such performance improved significantly the balance of payments situation by reducing the deficit from $19 million in 1979 to $4 million in 1980. The rate of inflation was an estimated 18% in 1980 and would have been greater if not for a conservative monetary policy and price control on a number of essential items. Export earnings increased $43 million, or 50%, from the 1979 level. After increasing more than 25% in 1979, imports increased only 6% in 1980 to a level of $141 million owing to the decline in investment and stabilization of petroleum prices. The balance of trade deficit was $9.8 million in 1980, a marked improvement from the 1979 level of $45.1 million.

The mineral output for Belize accounted for only a fraction of 1% of the GDP. Such activity was limited to the production of limestone, marl, and sand and gravel, all of which were primarily used in construction of the Northern Highway between Orangewalk and Belize City. Mineral resources are deficient or nonexistent in Belize for the majority of metals and nonmetals, although the Government and others continue to believe that petroleum must exist in Belize. The proximity to Mexican oilfields and the growing finds in the Petén area of Guatemala support this expectation. The Government continues encouraging exploration onshore and offshore and offers terms that

are generally similar to worldwide agreements. Major oil companies left the country in the past after frustrating efforts to find oil. The record of dry holes drilled in Belize since the 1950's has been discouraging.

In December 1980, the Organization of American States meeting in Washington backed the United Nations request to Britain to grant Belize independence in 1981. Britain was planning to call a constitutional conference early in 1981 to arrange a timetable for Belizean independence, which was expected to take place in the autumn of 1981.

Table 1.—Central American countries: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
BELIZE					
Stone, sand and gravel:					
Limestone	1,200,000	197,500	456,000	455,513	[2]440,640
Marl	120,000	914,000	3,900,000	3,851,340	[2]2,690,000
Sand and gravel	365,000	666,000	960,000	959,720	[2]817,500
COSTA RICA					
Cement	361,988	405,907	425,432	438,000	[2]553,699
Clays: Kaolin	500	460	530	480	500
Diatomite	717	680	610	590	600
Gold[e] troy ounces	9,600	12,200	15,900	16,718	16,000
Lime	5,400	6,300	7,200	9,000	7,500
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	363	[e]757	1,807	1,900	[2]742
Kerosine and jet fuel do.	159	[e]285	233	230	[2]285
Distillate fuel oil do.	440	[e]444	3,824	4,000	[2]1,091
Residual fuel oil do.	719	[e]976			[2]1,432
Other do.	66	[e]172	--		[2]186
Refinery fuel and losses do.	37	[e]122	212	220	[2]45
Total do.	1,784	[e]2,756	6,076	6,350	[2]3,781
Pumice	1,200	1,272	1,446	1,260	1,200
Salt, marine	20,000	27,000	34,200	46,000	40,000
Silver[e] troy ounces	1,608	1,350	1,640	2,000	1,600
Stone, sand and gravel:					
Crushed rock and rough stone cubic meters	450,000	518,000	559,500	602,000	600,000
Limestone and other calcareous materials	52,800	57,000	55,100	[e]53,000	55,000
Sand and gravel cubic meters	190,000	224,000	238,900	260,000	250,000
EL SALVADOR					
Aluminum metal including alloys, semimanufactures	1,621	1,950	2,268	2,313	[2]1,587
Cement	322,165	375,000	520,237	591,158	[2]519,892
Gold, fine troy ounces	3,007	2,156	3,619	2,720	[2]2,492
Gypsum[e]	6,000	7,000	7,000	7,000	9,000
Iron and steel metal:					
Steel, crude	[e]11,000	13,600	[e]13,600	[e]14,000	14,000
Semimanufactures	21,358	27,575	37,907	27,198	[2]30,959
Limestone	486,016	560,000	750,000	900,000	[2]850,000
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	1,095	1,213	1,236	1,303	1,270
Jet fuel do.	[r]85	85	93	--	--
Kerosine do.	[r]371	372	385	391	390
Distillate fuel oil do.	1,469	1,601	1,665	1,435	1,500
Residual fuel oil do.	1,763	1,678	1,412	1,713	1,600
Other:					
Liquefied petroleum gas do.	147	316	294	315	300
Asphalt do.		134	163	136	150
Refinery fuel and losses do.	237	84	106	[e]110	100
Total do.	[r]5,167	5,483	5,354	5,403	5,310
Salt[e]	23,000	25,000	27,000	27,000	27,000
Silver, fine troy ounces	166,289	112,245	185,060	151,582	146,202
GUATEMALA					
Antimony, mine output, metal content	1,120	[r]916	230	660	[2]556
Bante	--	--	1,330	3,600	[2]4,610
Cement	445,369	490,848	515,079	573,643	[2]568,875
Clays:					
Bentonite	[e]10	--	2,593	[e]2,700	2,600
Other	96,375	104,830	124,991	131,036	[2]169,861

See footnotes at end of table.

Table 1.—Central American countries: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
GUATEMALA —Continued					
Copper, Cu content of concentrates	r3,500	r2,500	2,060	1,768	2842
Feldspar	e20,000	13,071	15,377	10,601	221,530
Gypsum, crude:					
For cement manufacture	13,696	13,324	15,213	18,323	219,310
Other	NA	18,835	22,559	7,086	213,939
Iron ore, gross weight	2,578	3,166	4,755	2,895	3,500
Lead:					
Mine output, metal content	r200	r100	e100	e100	100
Metal, including secondary	110	127	119	90	292
Lime	45,514	45,581	44,292	40,575	235,580
Nickel, mine output, metal content[3]	--	298	1,079	6,199	26,744
Petroleum:					
Crude thousand 42-gallon barrels	r51	110	215	584	1,095
Refinery products:					
Gasoline thousand 42-gallon barrels	927	1,111	1,225	1,190	1,250
Jet fuel do	229	265	321	320	330
Kerosine do	218	233	243	264	250
Distillate fuel oil do	1,698	1,474	1,886	1,865	1,900
Residual fuel oil do	1,875	2,009	2,160	2,198	2,250
Other: Liquefied petroleum gas and unspecified do	68	43	51	58	50
Refinery fuel and losses do	172	63	72	e80	75
Total do	5,187	5,198	5,958	5,975	6,105
Pumice and related materials:					
Pumice	NA	NA	19,387	18,000	18,000
Volcanic ash	24,000	26,000	35,000	36,581	212,721
Salt	10,924	10,610	10,797	14,493	29,526
Silver, mine output, metal content[e] troy ounces	NA	NA	e10,000	e10,000	10,000
Stone, sand and gravel:					
Crushed and broken:					
Limestone thousand tons	945	941	825	815	2920
Unspecified (ballast, etc.) do	NA	903	e900	e900	900
Marble cubic meters	1,337	1,492	1,171	441	21,353
Quartz	2,755	2,600	2,500	e2,400	2,500
Sand and gravel:					
Silica sand	NA	40,074	43,370	40,320	70,000
Other cubic meters	868,369	844,223	788,605	788,494	640,000
Tungsten, mine output, W content of concentrate	--	--	--	--	250
Zinc, mine output, metal content[4]	457	1,024	1,000	e1,000	1,000
HONDURAS					
Antimony, mine output, metal content	r55	r70	78	46	223
Cadmium, mine output, metal content	231	263	260	204	2229
Cement	r254,000	r250,000	271,000	621,000	636,000
Copper, Cu content of lead and zinc concentrates	364	535	600	1,390	2297
Gold troy ounces	2,280	2,481	e2,500	1,501	22,027
Gypsum	e10,000	18,144	e22,600	e22,600	22,600
Iron and steel semimanufactures	NA	26,308	25,000	e24,000	24,500
Lead, mine output, metal content	21,100	20,600	21,800	16,400	215,171
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	701	713	690	730	2685
Jet fuel do	77	76	74	99	2138
Kerosine do	270	299	289	358	2329
Distillate fuel oil do	1,368	1,251	1,211	1,356	21,437
Residual fuel oil do	891	616	596	685	2841
Other: Liquefied petroleum gas and unspecified do	72	60	58	39	232
Refinery fuel and losses do	71	273	264	218	2186
Total do	3,450	3,288	3,182	3,485	23,648
Salt[e]	32,000	32,600	32,600	32,600	32,600
Silver thousand troy ounces	3,184	2,819	2,788	2,434	21,766
Stone:					
Limestone	NA	496,457	e500,000	e500,000	500,000
Marble	NA	42,184	43,000	e43,000	43,000
Zinc ore and concentrate, metal content	24,850	26,542	24,300	22,000	21,559
NICARAGUA[5]					
Cement	r226,000	r226,322	199,000	86,158	2153,926
Copper, mine output, metal content	r631	r300	e100	--	--
Gold, mine output, metal content troy ounces	75,841	65,764	73,947	61,086	260,000
Gypsum and anhydrite, crude[e]	30,000	36,000	36,000	36,000	40,000
Lead ore and concentrate, metal content	1,273	956	400	--	--
Lime[e]	r26,300	r36,000	37,000	36,000	40,000

See footnotes at end of table.

Table 1.—Central American countries: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1976	1977	1978	1979[p]	1980[e]
NICARAGUA[5] —Continued					
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	1,010	1,207	1,421	1,030	[2]1,108
Jet fuel do	185	225	214	115	[2]147
Kerosine do	145	117	124	103	[2]106
Distillate fuel oil do	1,231	1,388	1,328	947	[2]1,255
Residual fuel oil do	1,650	1,762	1,695	777	[2]966
Other:					
Liquefied petroleum gas do	188	185	186	143	[2]163
Asphalt do	150	112	[e]110	49	[2]101
Unspecified do	67	58	[e]59	38	[2]45
Refinery fuel and losses do	211	122	122	162	[2]196
Total do	4,837	5,176	5,259	3,364	[2]4,087
Salt, marine[e]	[r]14,200	16,000	18,000	18,000	20,000
Sand cubic meters	NA	[e]76,038	[e]80,000	[e]80,000	NA
Silver, mine output troy ounces	208,217	153,492	482,000	390,406	[2]164,000
Zinc ore and concentrate, metal content	14,330	10,142	3,600	--	--
PANAMA					
Cement	282,673	270,672	300,000	466,144	500,000
Clays and clay products:					
Crude	272,012	207,611	183,019	206,892	[2]183,182
Products cubic meters	[r]45,131	[r]34,159	27,160	31,497	[2]40,603
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	[e]2,343	[e]2,500	2,372	2,555	[2]1,974
Jet fuel do	[e]1,936	[e]1,850	1,146	1,095	[2]1,000
Kerosine do	[e]143	[e]250	83		[2]49
Distillate fuel oil do	[e]4,626	[e]4,500	4,563	4,745	[2]3,000
Residual fuel oil do	[e]9,639	[e]10,100	7,426	7,300	[2]7,009
Other:					
Liquefied petroleum gas do	[e]346	--	312		256
Asphalt do	[e]101	[e]50	91	730	5
Unspecified do	[e]407	[e]1,350	221		
Refinery fuel and losses do	[e]838	[e]800	723	730	[7]356
Total do	[e]20,379	[e]21,400	16,937	17,155	[2 8]13,642
Salt, marine	12,514	21,021	15,233	18,805	[2]19,000
Stone, sand and gravel:					
Limestone[6]	211,381	307,371	416,363	478,322	[2]536,250
Other thousand cubic meters	398	371	945	722	[2]724

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Oct. 5, 1981.

[2]Reported figure.

[3]Ni content of sinter.

[4]Exports.

[5]In addition to the commodities listed, Nicaragua produces a small but undetermined quantity of cadmium contained in zinc concentrates for export.

[6]Excludes approximately 8,000 cubic meters per year, apparently dimension stone.

[7]Refinery fuel is apparently included as a part of the products listed above; subtraction of the reported detail from the reported total gives a result of -7, indicating a net gain as a result of refining operations, but this cannot allow for refinery fuel.

[8]Detail adds to 7 more than this reported total; see footnote 7.

Table 2.—Belize: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	Destinations, 1978	
		United States	Other (principal)
METALS			
Iron and steel metal:			
Scrap	78	--	Mexico 54.
Steel, primary forms	120	--	All to Guatemala.
NONMETALS			
Cement	6	--	Do.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	2,899	--	Bunkers 2,712; Guatemala 187.
Kerosine do	73,571	--	Bunkers 73,517; Guatemala 54.
Distillate fuel oil do	3,969	--	Bunkers 3,820; Guatemala 134.

Table 3.—Belize: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	Sources, 1978	
		United States	Other (principal)
METALS			
Aluminum metal including alloys, all forms	115	83	Netherlands 24.
Copper metal including alloys, all forms	13	7	United Kingdom 3.
Iron and steel metal:			
Scrap	14	3	United Kingdom 11.
Semimanufactures:			
Bars, rods, angles, shapes, sections	2,325	114	United Kingdom 1,347; Belgium-Luxembourg 347; Guatemala 313.
Universals, plates, sheets	6,265	96	United Kingdom 5,935; Belgium-Luxembourg 158.
Hoop and strip	9	7	United Kingdom 2.
Wire	277	7	West Germany 161; Czechoslovakia 83.
Tubes, pipes, fittings	2,495	239	Canada 2,031; United Kingdom 186.
Castings and forgings, rough	5	2	El Salvador 1; United Kingdom 1.
Lead metal including alloys, all forms	20	--	All from United Kingdom.
Zinc metal including alloys, all forms	1	1	
NONMETALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	2	1	NA.
Cement	13,281	30	Mexico 6,635; Colombia 4,099; Panama 1,966.
Clays and clay products:			
Crude clays	105	94	Belgium-Luxembourg 10.
Products including nonclay refractory brick	126	44	United Kingdom 68; Mexico 9.
Diatomite and other infusorial earth	14	--	Mexico 13.
Fertilizer materials:			
Manufactured	1,890	1,883	NA.
Ammonia	9	7	NA.
Gypsum and plasters	8	5	NA.
Lime	809	3	Mexico 803.
Salt and brines	589	36	Mexico 465; United Kingdom 54; Canada 34.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	271	177	United Kingdom 93.
Soda ash	11	6	Mexico 5.
Stone, sand and gravel	28	15	NA.
Sulfuric acid, oleum	31	1	Netherlands 18; United Kingdom 10.
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	39	24	United Kingdom 9; Honduras 3.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades	1,934	1,930	United Kingdom 4.
Hydrogen, helium, rare gases	1	1	
Petroleum refinery products:			
Gasoline -- thousand 42-gallon barrels	171,369	--	Mainly from Netherlands Antilles.
Kerosine -- do.	134,811	--	All from Netherlands Antilles.
Distillate fuel oil -- do.	185,717	--	Netherlands Antilles 132,594; Mexico 53,123.
Residual fuel oil -- do.	23,223	--	All from Netherlands Antilles.
Lubricants -- do.	11,886	7,301	Netherlands Antilles 4,067.
Liquefied petroleum gas -- do.	24,847	--	Mainly from Mexico.
Other -- do.	6,354	1,606	Mexico 2,204; El Salvador 1,323; Jamaica 1,176.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4	NA	United Kingdom 3.

NA Not available.

COSTA RICA

The rate of economic growth in 1980 was the lowest for the Costa Rican economy in more than a decade and continued a steady downward growth trend since 1977. The GDP grew in real terms by about 1.6% to an estimated $4.85 billion[3] at current prices. Disequilibrium in the economy was reflected in the balance of payments, which registered a deficit in the current account of $653 million during 1980. The rate of infla-

tion increased to 23%.

Costa Rica's trade balance continued to deteriorate; coffee prices during 1980 decreased as oil prices increased. Exports were $1.0 billion or about 8% higher than in 1979, while imports continued at a high level, reaching $1.5 billion by yearend, an increase of 9% over that of 1979. About 15% of Costa Rica's import bill was accounted for by petroleum imports.

On October 8, 1980, the Costa Rican financial authorities decided to allow the colón to float. Previously the exchange rate had stood at 8.57 colónes to the U.S. dollar, but following the decision to float, the colón rose to 13.25 to the dollar.

Costa Rica's new mineral code approved by the Economic Affairs Committee was reportedly not passed by the legislature. As a result, exploration for copper in the Talamanca district by Aluminios Suizos y Minería de Costa Rica (Samcosa), a subsidiary of Alusuisse Charter Consolidated, and Mitsubishi was apparently delayed.

Costarricense de Desarrollo (Codesa), the Costa Rican development agency, signed an agreement with Romania at the end of 1980 to develop the bauxite deposits in the south of the country. The low-grade bauxite, located at San Isidro on the river El General, was previously of interest to Aluminum Co. of America (Alcoa) in 1976 and Reynolds Aluminum Co. in 1979. The Romanians may also supply a plant for the production of aluminum. This would depend upon the supply of 600 megawatts of electricity from the 760-megawatt Boruca hydroelectric power project in Puntarenas Province.

The Canadian Barranca Corp. Ltd. confirmed that production at the Santa Clara open pit gold mine in Costa Rica, of which the company owns 40%, has begun at the rate of 1,500 tons of ore per day. The company's partner, United Hearne Resources Ltd., expects an increase to 3,000 tons per day within approximately 6 weeks. The current ore reserve is 4,100,000 tons with an average grade of 1.6 grams of gold per ton in the Mondongo zone alone. A further large potential exists to the north and west. After completing about 75% of the drilling program on its Río Tigre gold prospect on the Osa Península, Barranca Corp. reported disappointing results. No further drilling is planned at present.

Allis-Chalmers had the major contract from Codesa to build a new 1,300-metric-ton-per-day dry process cement plant in Guanacaste Province, 75 miles west of San José. Financing is by the External Bank of Spain and several others. Part of the production is destined for markets in Costa Rica and Nicaragua.

The energy sector has been given priority investment status. Exploration efforts have increased, and oil deposits with a possible yield of 60,000 barrels of oil per day, have been discovered in a 36-square-kilometer zone known as Watsi-Cocoles. Both the Caribbean and Pacific continental platforms have been of interest to various oil companies. Mexico's PEMEX, the state oil agency, started oil exploration work in Costa Rica's Baja Talamaca as part of Mexico's technical cooperation offered by the Mexican Government in August 1980.

Mexico and Venezuela agreed to help Costa Rica—as well as nine other Central American and Caribbean countries—by lending it back 30% of the $250 million worth of crude oil that Costa Rica will buy from them in 1981. These funds will be used to help finance energy generation and distribution projects under loans of up to 20 years repayment at 2% per year interest.

In September 1980, the Government stated to the legislative assembly that oil exploration and production is to be nationalized and that the energy aid program undertaken by Mexico and Venezuela would enable the country to suspend foreign participation in oil exploration. PEMEX continued its technical assistance to the Government in oil exploration. Seismic work was being carried out in Baja Talamaca and on the Atlantic coast near Cahuita. The negotiations with Mexico and Venezuela had allowed the Puerto Limón refinery, which was acquired from the Allied Chemical Corp. by the Government under the name of Refinadora Costarricense de Petróleo (RECOPE), to expand from 10,000 barrels per day capacity to 17,000 barrels per day.

The Government was giving high priority to the development of its hydroelectric resources to reduce its dependence on imported petroleum to generate electricity. Installed hydroelectric capacity rose to 668 megawatts in 1979, when the Arenal hydroelectric project went onstream compared with the 37 megawatts of 1950. Hydropower now represents 69% of the total electrical output of the country. Providing additional cooperation for this effort, the Interamerican Development Bank (IDB) in 1980 ap-

proved a loan of $82.5 million to the Institute Costarricense de Electridad (ICE), Costa Rica's power agency, to construct the 90-megawatt Ventanas-Garita hydroelectric powerplant near San Miguel de Turrúcares in Alajuela Province, using the waters from the Virilla and Ciruelas Rivers. In 1977, IDB approved a loan of $4.1 million to enable Costa Rica to drill test holes in geothermal fields located in the slopes of the Miravalles volcano in the Province of Guanacaste to determine the feasibility of using geothermal power to generate electricity. Based on results obtained, IDB in 1980 approved a loan of $8.8 million to ICE to drill four deep holes to assure an adequate flow of steam for the country's first 55-megawatt generator using geothermal power. The plant was expected to come onstream in 1981.

By 1985, the electrical generating capacity of Costa Rica is projected at 621 megawatts hydropower, 205 megawatts thermal power, and 55 megawatts geothermal, for a total of 881 megawatts. Costa Rica may become an exporter of electricity to neighboring Panamá and Nicaragua after the inauguration of the 760-megawatt Boruca hydroelectric project on the Rio Grande de Térraba in the south of the country.

Table 4.—Costa Rica: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Destinations, 1979	
				United States	Other (principal)
METALS					
Aluminum metal including alloys, all forms	505	321	126	33	Nicaragua 25; El Salvador 20; Guatemala 19.
Copper metal including alloys, all forms	NA	NA	34	20	El Salvador 9.
Iron and steel:					
Metal:					
Scrap	NA	NA	19	--	United Kingdom 15.
Semimanufactures:					
Bars, rods, angles, shapes, sections	2,070	1,207	394	--	Nicaragua 263; El Salvador 106.
Universals, plates, sheets	17,014	12,689	13,074	--	Nicaragua 4,639; El Salvador 4,481; Panama 2,810.
Wire	--	183	254	--	Honduras 105; Guatemala 85.
Tubes, pipes, fittings	6,309	5,625	3,962	--	Panama 1,544; Nicaragua 1,213.
Lead metal including alloys, all forms	NA	NA	39	--	Panama 34.
Silver metal including alloys, unwrought and partly wrought value, thousands	NA	NA	$371	$371	
Zinc metal including alloys, all forms	NA	NA	21	21	
Other: Base metals including alloys, all forms	NA	NA	203	141	United Kingdom 54.
NONMETALS					
Abrasives, n.e.s.:					
Natural	1,028	NA	695	--	All to El Salvador.
Grinding and polishing wheels and stones	NA	NA	89	--	All to Nicaragua.
Cement	329	243	961	--	All to Honduras.
Clay and clay products including nonclay refractory brick	NA	NA	90	--	Panama 41; Honduras 25.
Diatomite and other infusorial earth	--	--	1	--	All to Nicaragua.
Fertilizer materials, manufactured:					
Nitrogenous	NA	NA	151	--	Do.
Other including mixed	107,995	83,252	61,113	--	Panama 28,954; Peru 21,095.
Lime	NA	NA	1,895	--	Honduras 1,510; Panama 385.
Sodium and potassium compounds, n.e.s.: Soda ash	NA	NA	10	--	All to Panama.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	NA	NA	116	--	Guatemala 97; West Germany 19.
Worked	NA	NA	36	--	All to West Germany.
Calcareous stone	NA	NA	1,590	--	Panama 1,584.
Sulfur:					
Elemental, all forms	NA	NA	5	--	All to El Salvador.
Sulfuric acid, oleum	NA	NA	209	--	Nicaragua 119; Panama 90.

See footnotes at end of table.

Table 4.—Costa Rica: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Destinations, 1979	
				United States	Other (principal)
NONMETALS —Continued					
Other: Building materials of asphalt, asbestos and fiber cements,and unfired nonmetals	4,799	3,751	863	141	Honduras 368; El Salvador 160; Panama 108.
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	NA	NA	697	--	All to Panama.
Distillate fuel oil do	35,353	37,114	26,923	--	All to bunkers.
Lubricants do	--	2,429	--		
Liquefied petroleum gas do	3,608	--	--		
Unspecified do	NA	NA	798	--	All to Panama.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	NA	18	--	All to Honduras.

NA Not available.

Table 5.—Costa Rica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Sources, 1979	
				United States	Other (principal)
METALS					
Aluminum metal including alloys, all forms	4,559	4,120	3,856	1,065	France 1,074; El Salvador 511; Panama 332.
Copper metal including alloys, all forms	2,023	2,185	2,544	531	Peru 1,498; Chile 225.
Iron and steel metal:					
Scrap	NA	NA	192	44	Panama 117; Japan 25.
Pig iron, ferroalloys, similar materials	NA	463	951	75	Canada 466; West Germany 275.
Steel, primary forms	43,152	36,368	25,515	19,336	Argentina 4,903; Canada 635; Japan 487.
Semimanufactures:					
Bars, rods, angles, shapes, sections	18,165	27,148	17,757	1,199	Japan 5,260; Brazil 2,373; El Salvador 2,360.
Universals, plates, sheets	84,084	81,215	89,897	1,218	Japan 79,100; West Germany 6,676; France 1,636.
Hoop and strip	553	621	582	186	Japan 101; Belgium-Luxembourg 81; West Germany 78.
Rails and accessories	2,532	NA	5,783	23	Canada 5,145; Japan 511.
Wire	3,878	5,284	5,854	147	Japan 2,284; Brazil 984; Honduras 790.
Tubes, pipes, fittings	5,877	8,641	4,016	1,898	Japan 969; Spain 244; Panama 205.
Castings and forgings, rough	--	66	103	10	Colombia 41; Japan 32; United Kingdom 10.
Lead metal including alloys, all forms	392	344	271	6	Peru 123; Belgium-Luxembourg 94; Mexico 41.
Silver and platinum-group metals including alloys, unwrought and partly wrought value, thousands	$131	$190	$409	$363	France $36.
Tin metal including alloys, all forms	--	19	16	5	United Kingdom 5; Mexico 3; Peru 2.
Zinc metal including alloys, all forms	4,608	4,096	4,967	10	Mexico 3,052; Canada 1,117; Peru 785.
Other:					
Ores and concentrates	739	1,146	1,129	3	Mexico 1,126.
Base metals including alloys, all forms	40	36	28	24	Belgium-Luxembourg 2.
NONMETALS					
Abrasives, n.e.s	75	91	108	31	West Germany 23; Brazil 21.

See footnotes at end of table.

Table 5.—Costa Rica: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Sources, 1979	
				United States	Other (principal)
NONMETALS —Continued					
Asbestos, crude	1,389	1,243	1,167	46	Canada 579; Australia 284; West Germany 258.
Boron materials: Oxide and acid	NA	NA	66	40	Mexico 25.
Cement	4,213	13,735	5,999	5	Belgium-Luxembourg 2,311; Japan 1,837; West Germany 1,561.
Clay products including nonclay refractory brick	4,255	6,237	11,129	6,086	Nicaragua 1,445; Spain 746; Colombia 673.
Fertilizer materials:					
Crude	NA	NA	211	146	West Germany 50.
Manufactured:					
Nitrogenous	92,815	45,871	26,518	4,267	West Germany 13,990; Hungary 3,772; Romania 3,480.
Phosphatic	64,081	31,455	22,941	20,352	Mexico 2,589.
Potassic	58,795	44,702	52,863	27,728	Mexico 8,903; West Germany 8,824; Canada 5,403.
Other including mixed	11,786	28,702	5,639	323	West Germany 5,197.
Lime	NA	NA	705	17	Nicaragua 673.
Salt and brines	4,005	4,967	7,756	633	Nicaragua 4,899; El Salvador 2,169.
Sodium compounds, n.e.s.:					
Caustic soda	NA	NA	5,017	714	Nicaragua 3,807; France 176; United Kingdom 108.
Soda ash	NA	NA	7,307	6,531	West Germany 312; United Kingdom 305.
Stone, sand and gravel	16,078	25,729	37,642	20,274	Nicaragua 14,087; Honduras 2,270.
Sulfur: Sulfuric acid, oleum	630	NA	308	22	El Salvador 204; Panama 70.
Other:					
Crude	4,480	6,462	7,654	3,168	Guatemala 2,839; United Kingdom 678.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	564	826	378	322	Mexico 20; Guatemala 12.
MINERAL FUELS AND RELATED MATERIALS					
Coal, coke, peat	544	474	604	314	West Germany 222; Colombia 40.
Hydrogen, helium, rare gases	NA	NA	10,904	328	Mexico 9,545; West Germany 478; Canada 300.
Petroleum and refinery products:					
Crude and partly refined thousand 42-gallon barrels	2,406	3,005	2,631	--	Venezuela 1,348; Netherlands Antilles 1,171.
Refinery products:					
Gasoline do.	794	749	617	4	Netherlands Antilles 611.
Kerosine do.	52	42	36	10	Netherlands Antilles 21; Venezuela 5.
Distillate fuel oil do.	2,182	2,519	2,453	2	Netherlands Antilles 1,928; Venezuela 498.
Residual fuel oil do.	59	18	--		
Lubricants do.	144	137	150	72	Netherlands Antilles 28; El Salvador 17.
Mineral jelly and wax do.	23	22	25	6	West Germany 16.
Liquefied petroleum gas do.	81	93	157	(1)	Mainly from Venezuela.
Other do.	164	247	190	9	Netherlands Antilles 109; Venezuela 71.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,534	3,424	4,678	2,555	Hungary 1,250; Netherlands Antilles 835.

NA Not available.
[1]Less than 1/2 unit.

EL SALVADOR

El Salvador's real growth in its GDP averaged 5.1% between 1975 and 1977, was 4% in 1978, but fell by 1.5% in 1979 and by 6% in 1980, reflecting in particular a sharp fall in private investment associated with loss in business confidence. In current prices, the 1980 GDP reached an estimated $3.8 billion.[4] The inflation rate averaged 30% during 1980.

Civil strife was severely damaging El

Salvador's economy. The balance of payments deficit of $94 million was increasing and capital flight estimated by the Government at $1.5 billion over the past 2 years continued. In addition, inflation was accelerating and the level of unemployment remained high.

The economy of El Salvador is still primarily agricultural, with coffee representing more than 50% of total exports. The socioeconomic reforms announced by the Government in 1980 are expected to have a positive long-term impact. The land reform announced in March 1980 is being implemented in three stages. The Government has also initiated banking reforms by which it assumed 51% of the ownership of all local banks and savings institutions.

El Salvador's new petroleum law was expected to go into effect in early 1981. According to the new statute, all exploration costs will be borne by private petroleum companies in return for relatively generous exploitation terms if petroleum is discovered. Individual contracts will establish exploration periods of up to 5 years with possible renewals up to 20 years. During the agreed exploitation periods, the private producer will receive a percentage of petroleum output. Taxes will be based on production levels. CEL, the Government energy utility agency, reserves the right to purchase this petroleum, if necessary, to supply the domestic market at international prices. The proposed new law stipulates a similar procedure for natural gas producers.

The mining industry of El Salvador contributed about 0.1% of the country's GDP in 1980. The mineral resources of the country include gold, silver, copper, iron ore, sulfur, mercury, lead, zinc, salt, and lime, but the reserves are small and not all are exploited. The most important mining operation in El Salvador concerns the gold mines of San Cristobal S.A., a wholly owned subsidiary of Canadian Javelin Ltd.—namely El Divisadero and Los Encuentros Mines. Javelin still retains an option on the Monte Mayor silver-gold mine, including the Banadero and Tempisque veins where exploration has yielded some promising results.

El Dorado gold-silver mine, in the Cabañas Department, continued to be active in 1980, although the Bruneau Mining Corp. will not make further investments until the end of the current political unrest. The 1.12-square-kilometer mining concession has reserves estimated at 200,000 tons of ore, grading 6.2 grams per ton of gold and 23.7 grams per ton of silver. It is surrounded by an additional 37-square-kilometer exploratory concession where 3,000 meters of exploratory drilling is scheduled in the near future to determine more accurate reserves figures. The reactivation of a 300-ton-per-day processing plant was postponed until at least 1984.

El Salvador's production of gold and silver in 1980 declined 8% and 3.5%, respectively, compared with 1979 production.

Reports from Alcoa and from Siderúrgica Salvadorena S.A. and Acero S.A., indicate that the production of aluminum metal semimanufactures and steel semimanufactures declined also in 1980, 31% and 12%, respectively, compared with 1979 output.

Considerable progress was achieved during the first half of 1980 toward revitalizing the local fertilizer industry. Seres S.A. was in the process of establishing a joint venture operation based on the old Fertica ammonium sulfate and NPK facilities at Acajutla with Pullman Kellogg for the supply of technical and economic assistance. The project, known as Fertisal, involves the revamping of the Acajutla plant for the production of complex fertilizers based on phosphoric acid, as well as ammonium sulfate. Seres intends to maintain the capacity of 240,000 tons per year to cover domestic demand but will eventually increase production for export to other Central American markets. Fertisal is to be organized as a cooperative enterprise, with equity shares to be offered to workers within the company as well as merchants, farmers, and other private investors.

Allis-Chalmers was granted the contract by Cemento de El Salvador S.A. for expanding the production capacity of the El Ronco plant located near Metapán from 900 tons per day to 1,000 tons per day. Allis-Chalmers assisted Cemento de El Salvador in arranging financing for the expansion from the Export-Import Bank of the United States, Private Export Funding Corp. (PEFCO), and three major U.S. commercial banks.

El Salvador still relies entirely on imported oil, the cost of which increased to 19% of export earnings in 1979, compared with the 16% share in 1978. The Comisión Nacional de Energía (CNE) reported that 14,000 barrels per day of oil are currently being consumed and that petroleum represents

29% of El Salvador's energy consumption. Under the San José agreement signed between Mexico and Venezuela, El Salvador will receive half its oil supply from each country, up to a maximum of 16,000 barrels per day.

A bilateral agreement signed on January 15, 1980, with Venezuela provides for 30% of the oil bill to be paid in local currency (colónes) under a general development loan at 4% interest for 5 years. If the Government of El Salvador invests these funds in energy development, the loan will automatically receive better terms: 20 years at 2% interest. The final agreement on the terms of a concessionary loan from Mexico was not reached but was expected to be similar to the Venezuelan terms.

Based on results from 110,000 barrels already processed at Refinería Petrolera Acajutla S.A. (RASA), Government officials believe that major technical modifications will not be necessary to process Mexican crude oil. RASA, the only refinery in the country, is owned jointly by Exxon and Shell with a minority share in the hands of local stockholders. CNE is formulating two plans: The first covers how to use petroleum more efficiently in the coming years, and the second concerns alternate energy sources to be developed over the next 20 years. Currently, geothermal power provides for 15% of total demand, and hydroelectric power accounts for 45%. Government officials estimate that about 19% of hydroelectric potential is now being exploited and that with the completion of the San Lorenzo Dam in 1984, 35% of the potential will be initiated. Collaboration with Honduras would enable the country to tap the potential of the Río Lempa located along their common border. The possibility of constructing small, independent hydroelectric plants on minor rivers was being considered.

Preliminary studies undertaken by the United Nations indicate possible offshore oil deposits, the exploration of which is to be encouraged by the Government. Alternate sources of energy were being studied involving the sun, windmills, alcohol, and vegetation converted into butane gas.

Table 6.—El Salvador: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Destinations, 1979	
				United States	Other (principal)
METALS					
Aluminum metal including alloys, all forms	2,749	2,822	2,947	27	Guatemala 2,105; Costa Rica 489; Nicaragua 169.
Copper metal including alloys, all forms	100	NA	23	--	Guatemala 17; Mexico 6.
Iron and steel metal, all forms	6,621	13,228	32,286	20	Ecuador 17,083; Guatemala 11,249; Costa Rica 2,456.
Lead metal including alloys, all forms	NA	NA	22	--	All to Guatemala.
Silver metal including alloys, unwrought and partly wrought troy ounces	(1)	(2)	151,816	32	Mainly to Switzerland.
Tin metal including alloys, all forms	NA	NA	4	--	Costa Rica 2; Guatemala 2.
Other: Ash and residue containing nonferrous metals	NA	NA	482	84	West Germany 250; Haiti 123.
NONMETALS					
Cement	NA	60,232	119,569	--	Mainly to Guatemala.
Clays and clay products:					
Crude clays	NA	NA	475	--	Costa Rica 270; Panama Canal Zone 96; Guatemala 87.
Products including nonclay refractory brick	NA	NA	415	--	Guatemala 387; Honduras 28.
Fertilizer materials:					
Crude	NA	NA	91	--	All to Guatemala.
Manufactured	47,373	49,919	57,211	--	Do.
Lime	NA	NA	57	--	Do.
Salt and brines	23,238	20,817	21,703	--	Guatemala 18,868; Costa Rica 2,706.

See footnotes at end of table.

Table 6.—El Salvador: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Destinations, 1979	
				United States	Other (principal)
NONMETALS —Continued					
Stone, sand and gravel:					
Dimension stone	NA	NA	308	([3])	Mainly to Guatemala.
Sand, gravel, crushed rock	NA	NA	7	--	All to Guatemala.
Sulfuric acid, oleum	1,738	1,806	1,083	--	Guatemala 591; Costa Rica 223; Nicaragua 212.
Other:					
Crude	1,610	1,031	283	--	All to Guatemala.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	11,927	12,041	7,379	--	Mainly to Guatemala.
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades	NA	NA	11	--	All to Guatemala.
Petroleum refinery products:					
Gasoline—42-gallon barrels	16,567	NA	935	--	Do.
Distillate fuel oil—do	42,522	48,833	212,610	--	Do.
Lubricants—do	86,450	82,040	76,909	--	Costa Rica 35,700; Guatemala 27,349; Nicaragua 13,706.
Liquefied petroleum gas—do	19,349	NA	2,529	--	All to Guatemala.
Unspecified—do	51,338	67,802	65,765	--	Mainly to Guatemala.

NA Not available.
[1]Value given only at $498,000.
[2]Value given only at $825,000.
[3]Less than 1/2 unit.

Table 7.—El Salvador: Imports of mineral commodity

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Sources, 1979	
				United States	Other (principal)
METALS					
Aluminum metal including alloys:					
Unwrought	1,985	2,387	390	203	Canada 182.
Semimanufactures	4,034	4,055	3,617	1,171	France 815; West Germany 560; Guatemala 268.
Copper:					
Sulfate	19	NA	13	([1])	West Germany 9; United Kingdom 3; Guatemala 1.
Metal including alloys, all forms	2,388	2,346	2,674	63	Peru 2,376; Japan 81; Mexico 47.
Iron and steel metal:					
Scrap	47	12,122	28,091	23,891	Nicaragua 4,146.
Pig iron, ferroalloys, similar materials	4,168	5,208	6,239	107	Mexico 5,029; Brazil 780; Guatemala 222.
Steel, primary forms	17,432	5,309	4,691	96	Brazil 3,034; West Germany 1,481.
Semimanufactures	86,945	93,508	69,267	10,783	Japan 21,306; Guatemala 9,216; West Germany 7,128.
Lead metal including alloys, all forms	176	198	509	7	Mexico 414; Peru 80.
Nickel metal including alloys, all forms	1	NA	2	([1])	Guatemala 1; Mexico 1.
Platinum-group metals including alloys, unwrought and partly wrought—troy ounces	96	NA	1,415	--	Guatemala 1,350; West Germany 64.

See footnotes at end of table.

Table 7.—El Salvador: Imports of mineral commodity —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Sources, 1979	
				United States	Other (principal)
METALS —Continued					
Silver metal including alloys, unwrought and partly wrought troy ounces	25,110	NA	4,308	2,829	West Germany 1,286; Netherlands 193.
Tin metal including alloys, all forms	22	37	23	6	United Kingdom 14; Netherlands 2.
Zinc metal including alloys, all forms	299	546	260	14	Mexico 142; Peru 101.
Other:					
Ores and concentrates	1	NA	2	1	West Germany 1.
Ash and residue containing nonferrous metals	--	NA	5	--	All from Guatemala.
Base metals including alloys, all forms	4	NA	3	(1)	West Germany 2.
NONMETALS					
Abrasives, n.e.s	1,498	3,132	1,530	10	Costa Rica 704; Guatemala 677.
Asbestos, crude	4,242	3,243	3,312	164	Canada 2,361; Australia 776.
Cement	17,119	16,218	1,915	2	Belgium-Luxembourg 716; Japan 563; West Germany 234.
Clays and clay products:					
Crude	4,841	NA	5,584	2,057	Guatemala 3,394.
Products including nonclay refractory brick	4,127	4,868	4,328	1,381	Guatemala 814; Brazil 497; Mexico 433.
Diamond, industrial thousand carats	835	NA	570	165	Italy 365; Mexico 30; West Germany 10.
Diatomite and other infusorial earth	1,500	NA	359	57	Mexico 297.
Feldspar and fluorspar	1	NA	47	1	Guatemala 45.
Fertilizer materials:					
Crude	10,774	15,161	8,055	8,055	
Manufactured:					
Nitrogenous	299,305	213,649	118,155	38,007	Italy 23,231; Netherlands 18,010; Belgium-Luxembourg 15,437.
Phosphatic	32,085	51,854	24,929	24,768	United Kingdom 110; West Germany 51.
Potassic	13,720	3,653	13,991	400	Switzerland 10,859; Canada 2,501.
Other including mixed	37,005	49,497	72,311	39,796	Belgium-Luxembourg 23,459; West Germany 4,549; Netherlands 3,528.
Graphite, natural	7	NA	152	(1)	West Germany 112; Guatemala 39.
Gypsum and plasters	16,508	NA	20,428	35	Mainly from Guatemala.
Lime	9,193	7,628	5,810	1	Do.
Mica, all forms	10	NA	10	10	
Pigments, mineral, crude	1,800	NA	3,694	--	Do.
Salt and brines	6	NA	66	38	Canada 20; West Germany 8.
Sodium and potassium compounds, n.e.s.:					
Caustic soda	7,988	NA	6,143	595	Nicaragua 4,960; Guatemala 397.
Soda ash	1,544	NA	2,113	797	West Germany 335; Denmark 323; Guatemala 278.
Stone, sand and gravel:					
Dimension stone	6,972	NA	6,456	1	Mainly from Guatemala.
Sand, gravel, crushed rock	1,686	NA	1,273	85	Guatemala 1,135; Mexico 50.
Other	1,304	NA	625	153	Mexico 262; Guatemala 189.
Sulfur:					
Elemental, other than colloidal	5,556	40,577	14,781	--	All from Mexico.
Sulfuric acid, oleum	18,180	5,087	504	(1)	Nicaragua 431; Guatemala 64.
Talc, soapstone, pyrophyllite	292	NA	231	107	West Germany 47; Italy 35; Guatemala 31.
Other:					
Crude	323	4,381	461	113	Mexico 347.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	3,427	3,965	5,012	215	Guatemala 2,781; Nicaragua 1,772.

See footnotes at end of table.

Table 7.—El Salvador: Imports of mineral commodity —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979	Sources, 1979	
				United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	1	NA	--		
Coal and coke including briquets	721	525	530	269	Colombia 150; West Germany 86.
Petroleum:					
Crude and partly refined thousand 42-gallon barrels	6,022	4,940	4,507	--	All from Venezuela.
Refinery products:					
Gasoline 42-gallon barrels	30,563	38,888	31,389	3,414	Guatemala 21,734; Netherlands Antilles 6,223.
Kerosine ---do---	14,289	12,361	12,726	1,358	Nicaragua 5,931; Netherlands Antilles 2,678; Venezuela 1,520.
Lubricants ---do---	47,915	49,350	53,906	29,452	Netherlands Antilles 11,754; Nicaragua 7,390.
Mineral jelly and wax do	23,471	15,968	14,324	5,972	China 2,389; France 2,023; West Germany 1,475.
Liquefied petroleum gas do	3,113	9,118	11,601	24	Guatemala 10,324; Venezuela 1,050.
Unspecified ---do---	1,002	2,303	1,151	672	Guatemala 286; Mexico 186.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	37	NA	25	5	United Kingdom 15; West Germany 2; Netherlands 2.

NA Not available.
[1]Less than 1/2 unit.

GUATEMALA

Guatemala's economic growth rates have run above the Latin American average of 5% to an average of 7% per year during the recent past.

In 1980, the rate of growth of the GDP continued its downward trend to 3.5% compared with 8.3% in 1977, when coffee prices reached an alltime high. At current prices, 1980 GDP reached $7.8 billion.[5] The slowdown in growth is attributed to several factors. The continuation of the Central Bank's low interest rate policy induced a substantial outflow of capital in search of higher returns abroad. Another factor was the drop in construction as well as a lack of bank financing and business uncertainty because of unsettled conditions in neighboring countries and local political problems. A third factor was the disruption of trade in the Central American Common Market (CACM), where much of Guatemala's manufactured products have been exported in recent years.

The rate of inflation increased from 13% in 1979 to 15% in 1980, owing to petroleum price increases and the higher costs of imports in general. The petroleum import cost in 1980 rose 29% to $343 million, compared with $242 million in 1979, increasing the total imports 3% to $1.54 billion.

Total Guatemalan exports rose by 22% in 1980 to $1.51 billion. Guatemala expects to receive $43 million from petroleum exports in 1980, which will partially offset the overall balance of payments impact.

Perhaps the most significant medium-term economic development in recent years has been the discovery of oil in Guatemala. There is currently one company with a petroleum concession and three consortia with "risk" contracts to explore and exploit petroleum. These consortia are working under two different petroleum laws. The 1955 oil code establishes that once production begins, the oil companies are obligated to pay the Government a 12.5% royalty; in 1975, another law was passed increasing the Government's share to 51%. The 1978 law increases the Government's share to no less

than 55% of the sale price. The disparity has stimulated the effort by political forces to bring oil companies under one central code. The company in the center of this dispute is Petromaya S.A., a joint venture formed by Basic Resources International S.A. (BRISA), Shenandoah Guatemala, Saga Petroleum A/S, and recently, Ashland Oil Co., which has been exploring for petroleum for 10 years. The joint venture is currently producing crude oil from its fields in Rubelsanto (3,500 barrels per day) and Chinaja (1,600 barrels per day.). These levels of production are Government-imposed and have also been a point of dispute between the Government and Petromaya.

Oil production from the Rubelsanto Field in Alta Verapaz has reached about 12,000 barrels per day—thus supplying a substantial proportion of domestic consumption, estimated to be less than 25,000 barrels per day. BRISA was given permission to start using the recently completed $65 million pipeline from Rubelsanto to the Caribbean terminal at Puerto Barrios.

Guatemala's first petroleum exports departed for the United States in April 1980. The 120,000 barrels destined for refining in the United States were sold at $29.40 per barrel.

The mineral industry of Guatemala is still in an incipient stage of development. Currently, Guatemala is a modest producer of nickel, copper, antimony, zinc, and tungsten, and nonmetals such as calcium carbonate, cement, feldspar, gypsum, limestone, marble, silica sand, sand and gravel, and barite. Among hydrocarbons, crude oil and petroleum products are produced. Oil is produced in the northern part of the country and is becoming an increasingly valuable export commodity.

Guatemala is the third most important producer of nickel in Latin America, mainly from the El Estor Mine. In September 1980, the mine and the nickel processing plant at El Estor at the western end of Lake Izabal operated by Exploraciones y Explotaciones Mineras Izabal (Exmibal), 80% held by Inco Ltd. and 20% by Hanna Mining Co., has been closed and will remain shut for the whole of 1981 owing to high energy costs. The estimated operating loss for 1980 is $13 million. The cost of fuel oil for the mine has risen since the mine started production in 1978 from $11 to over $40 per barrel. At the same time, weak world demand has forced Inco's nickel prices down by 6%. In 1979, the mine produced 6,199 tons of nickel, and up to September 1980, output was 6,744 tons (57% of capacity) valued at about $65 million. The mine will be maintained on a standby basis, enabling a restart at the end of 1981 if that is economically warranted. It is estimated that to maintain the Exmibal operation on a standby basis, it will cost about $14 million in 1981. Closure, however, would result in cash savings of some $40 million.

Copper continued to be produced by Transmetales Limitada, a wholly owned subsidiary of Basic Resources International S.A. (BRISA) of Luxembourg. Production of copper declined 52% in 1980 compared with 1979 output.

Minas de Oriente S.A. (Minorsa), as owner with 40% equity in a joint venture with Asamera Inc. of Calgary, Canada, (with 60% equity) was planning to develop a base metal (copper, lead, zinc, and silver) property at Chiquimula in the southeastern part of Guatemala, where reserves were estimated at 1.8 million tons.

Baritas de Guatemala S.A. was seeking an investment of $1 million to proceed with the development of its barite mine, located at Cabulco municipality, Baja Verapaz Province. The reserves have been estimated at 1 million tons of barite. The company planned to mine at a rate of 200 tons per day in 1981. Production of barite in 1980 increased 20% to 4,610 tons compared with 3,680 tons in 1979. Greater production was stimulated by the increase in oil exploration in the country.

Minas de Guatemala S.A. has been mining antimony in small quantities for the past 10 years at the Anabella and Los Lirios Mines in the locality of Ixtahuacan, in Huehuetenango Province, at the rate of about 200 metric tons of ore per day. Reserves are still unknown, and no exploration is taking place at the present time.

Texaco Oil Co. was searching for oil in the northwest corner of Guatemala, only 60 kilometers from the rich oilfields of the Mexican State of Tabasco. Texaco's belief that oil can be found in Block D is based on the region's geology. According to the terms of the lease Texaco obtained from the Government, Texaco is committed to drill two 4,000-meter-deep wells by the end of Nov-

ember 1981. The company must also build a road from El Naranjo town to the drilling site within the interior of the block. Finally, Texaco must turn over all information it develops on Block D to the Minister of Mines. Texaco may extend the life of its lease for an additional year by drilling an additional 4,000-meter-deep well.

Production of cement declined in 1980 by less than 1% compared with 1979 output. F. L. Smith received in 1979 the latest expansion contract of the oldest cement producing firm in Latin America (since 1897). Cementos Novella S.A. was adding 1,600 metric tons per day to its San Miguel plant; 40% of the clinker will be sent to its older La Pedrera plant in Guatemala City. The new production line was scheduled to go onstream in early 1980.

Basic Resources International S.A. (BRISA) has committed itself to an exploratory drilling program covering blocks 87, 88, 90, 91, and 92 in Guatemala. Under a 40-year production contract, the company is to drill on each block within 6 months. BRISA officials indicated that extensive geological and seismic work done during the past 2 years has uncovered the presence of more than 20 major structures.

Ashland Oil Co. became the newest member of the joint venture led by BRISA. Ashland, expected to invest $50 million, is contracted to drill six exploratory wells with BRISA holding 50% of the interest in any commercial oil found in the structure of Ashland.

A consortium led by Getty Oil Co. (50%), and consisting of Monsanto (25%) and Texas Eastern (25%), was exploring in area B:B in northern Alta Verapaz and the southern Petén. The first well drilled by Getty Oil Co. reached a depth of 11,500 feet with only a minor show. Getty Oil Co. is contracted to drill five wells to a minimum depth of 9,000 feet and was expected to invest $19 million by the time the contract expires in June 1981.

Hispanoil was contracted to drill three wells to a minimum depth of 9,000 feet. The expected productive zone of the first well being drilled is between 3,000 and 12,000 feet. Hispanoil's contract expires in June 1981. Hispanoil was expected to invest over $12 million.

The Texaco-Amoco partnership continued its drilling operations under a contract signed in 1978, which requires two wells to be drilled to a minimum depth of 12,000 feet.

BRISA announced in July that the French state oil company, ELF-AQUITAINE, bought a 10% share in BRISA for about $34 million subject to approval of BRISA stockholders. ELF-AQUITAINE will assume technical direction of exploration operations as well as exploitation of existing wells. In September 1980, an exploration well was spudded on a new structure, La Felicidad, located 10 kilometers southwest of the Rubelsanto structure, which is already producing oil. The new exploration well is targeted for a depth of 14,000 feet at an estimated cost of $8 million.

In December 1980, the Secretary of Mining and Hydrocarbons announced that the Government of Guatemala had awarded a contract to a consortium of companies consisting of Hispanoil, ELF-AQUITAINE, and BRASPETRO for oil exploration and exploitation in Block E, which is in the northwest portion of the Petén. Seismic exploration was scheduled to begin in early 1981.

Two refineries were in operation in Guatemala. The first was operated by Texaco on the southern coast of Guatemala, south of Escuintla. This refinery has a capacity of 17,000 barrels per day. The second, located in Puerto Barrios along the Atlantic coast, was operated by Shell-Chevron refinery and has a refining capacity of 10,000 barrels per day.

A third of Guatemala's 4-year development plan has been allotted mainly to hydroelectric development. The Aguacapa plant, initiated in 1977, was practically completed, and the Chixoy plant was scheduled to come onstream by 1982. The $580 million Chulac hydroelectric project was being delayed because of lack of adequate financial arrangements. The agreement to interconnect the Guatemalan and Salvadoran energy grids, expected to become operational in 1981, is seen by officials as a major medium-term solution to the country's energy needs.

Table 8.—Guatemala: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	56	198	122	Honduras 41.
Semimanufactures	395	729	49	El Salvador 468; Honduras 183.
Copper metal including alloys:				
Unwrought	35	83	51	Netherlands 17; West Germany 15.
Semimanufactures	24	115	86	West Germany 29.
Iron and steel:				
Ore and concentrate	--	2,197	--	Honduras 2,178.
Metal:				
Scrap	--	2	--	Honduras 1.
Pig iron, sponge iron, powder, shot	2	33	--	Honduras 26; El Salvador 6.
Spiegeleisen, ferromanganese, other ferroalloys	--	21	--	Nicaragua 8; El Salvador 6; Honduras 6.
Steel, primary forms	10	2	--	El Salvador 1.
Semimanufactures:				
Bars, rods, angles, shapes, sections	4,992	5,301	--	Honduras 3,150; El Salvador 2,021.
Universals, plates, sheets	1,308	1,307	--	El Salvador 775; Nicaragua 276.
Hoop and strip	64	51	--	Honduras 36; El Salvador 14.
Rails and accessories	--	2	--	All to Costa Rica.
Wire	32	280	--	El Salvador 231.
Tubes, pipes, fittings	6,726	8,599	--	El Salvador 4,978; Honduras 3,273.
Castings and forgings, rough	1	--	--	
Lead metal including alloys:				
Unwrought	--	62	--	Mexico 46; Nicaragua 15.
Semimanufactures	5	6	--	El Salvador 3; Honduras 2.
Nickel metal including alloys, all forms	1,532	4,792	1,732	United Kingdom 2,914.
Tin metal including alloys, semimanufactures	3	1	--	All to El Salvador.
Zinc metal including alloys:				
Unwrought	18	292	--	West Germany 129; United Kingdom 66; Spain 52.
Semimanufactures	--	2	--	All to El Salvador.
Other: Base metals including alloys:				
Scrap	3,029	9,908	--	Spain 8,550; West Germany 1,358.
Unwrought and semimanufactures	305	22	--	All to El Salvador.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	671	1,643	--	El Salvador 1,353; Netherlands 289.
Grinding and polishing wheels and stones	60	17	--	El Salvador 13.
Asbestos, crude	--	4	--	All to Honduras.
Boron materials: Oxide and acid	1	--	--	
Cement	13	4	--	NA.
Clays and clay products:				
Crude clays	11,117	11,722	--	Honduras 8,207; El Salvador 3,346.
Products:				
Refractory including nonclay brick	507	208	38	El Salvador 133; Honduras 29.
Nonrefractory	616	1,147	--	El Salvador 846; Honduras 221.
Diatomite and other infusorial earth	--	2	--	All to El Salvador.
Fertilizer materials:				
Crude	--	8	--	All to Nicaragua.
Manufactured:				
Nitrogenous	12	160	--	El Salvador 108; Belize 39.
Other including mixed	88	60	--	Costa Rica 47; Honduras 12.
Gypsum and plasters	20,522	21,004	--	El Salvador 19,874; Costa Rica 988.
Lime	5,065	3,711	--	All to El Salvador.
Pigments, mineral, natural	3,572	5,910	2,457	El Salvador 3,301.
Precious and semiprecious stones value, thousands	$4	$1	$1	
Salt and brines	--	39	--	El Salvador 20; Honduras 18.
Sodium and potassium compounds, n.e.s.: Caustic soda	--	6	--	El Salvador 5.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	8,999	7,064	--	El Salvador 5,360; Mexico 1,180.
Worked	319	879	128	El Salvador 347; Japan 196.
Calcareous stone	867	246	--	El Salvador 227.
Gravel and crushed rock	1,497	546	--	El Salvador 397; Costa Rica 101.
Quartz and quartzite	5	NA	NA	NA.
Sulfur: Sulfuric acid, oleum	4,445	513	--	El Salvador 439.
Talc, steatite, soapstone, pyrophyllite	57	39	--	El Salvador 30; Nicaragua 9.
Other:				
Crude	2,916	3,101	NA	Costa Rica 2,577.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	1,402	1,118	--	El Salvador 993; Honduras 122.

See footnotes at end of table.

Table 8.—Guatemala: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades including briquets	8	--		
Petroleum refinery products:				
Gasoline—42-gallon barrels	1,156	(1)	--	All to El Salvador.
Distillate and residual fuel oils—do	7	--	--	
Lubricants—do	616	959	--	Costa Rica 371; El Salvador 280; Honduras 175.
Mineral jelly and wax—do	79	16	--	All to El Salvador.
Unspecified—do	122	98	--	El Salvador 77.

NA Not available.
[1]Less than 1/2 unit.

Table 9.—Guatemala: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	400	565	--	Canada 364; France 201.
Semimanufactures	2,585	2,592	295	El Salvador 1,139; Canada 312.
Copper metal including alloys:				
Unwrought	167	10	--	Republic of South Africa 6; Sweden 4.
Semimanufactures	591	441	100	Mexico 201; El Salvador 72.
Iron and steel:				
Ore and concentrate	3	--		
Metal:				
Scrap	73	5	--	All from Canada.
Pig iron, sponge iron, powder, shot	17	2	--	All from Italy.
Spiegeleisen, ferromanganese, other ferroalloys	334	344	90	Brazil 205; Mexico 48.
Steel, primary forms	28,814	29,618	18,971	Canada 4,533; El Salvador 3,643.
Semimanufactures:				
Bars, rods, angles, shapes, sections	45,624	727,447	2,685	Mexico 706,211; Belgium-Luxembourg 4,527.
Universals, plates, sheets	73,980	76,124	1,867	Japan 49,701; France 10,162; West Germany 9,534.
Hoop and strip	1,231	1,353	108	Japan 385; El Salvador 243; West Germany 194.
Rails and accessories	967	62	4	West Germany 39; El Salvador 19.
Wire	20,797	17,373	193	Australia 10,895; Brazil 1,825; Japan 1,526.
Tubes, pipes, fittings	7,124	5,652	3,041	West Germany 440; Japan 341.
Castings and forgings, rough	259	538	7	West Germany 344; Japan 73.
Lead metal including alloys:				
Unwrought	49	17	8	El Salvador 6.
Semimanufactures	65	205	19	West Germany 91; Belize 70.
Nickel metal including alloys, all forms	9	68	6	Canada 54.
Platinum-group metals including alloys, unwrought and partly wrought—value, thousands	--	$5	$5	
Silver metal including alloys, unwrought and partly wrought—do	$5	$32	$5	Mexico $27.
Tin metal including alloys:				
Unwrought	15	10	4	Mexico 2; United Kingdom 2.
Semimanufactures	34	40	7	West Germany 19; United Kingdom 13.

Table 9.—Guatemala: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc metal including alloys:				
Unwrought	3,926	4,530	3	Mexico 2,491; Canada 1,808.
Semimanufactures	19	13	6	Portugal 5.
Other:				
Ores and concentrates	2,320	3,300	2,001	Mexico 1,280.
Base metals including alloys, all forms	33	30	7	El Salvador 18.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	16	9	2	Brazil 6.
Grinding and polishing wheels and stones	239	143	16	Austria 32; Italy 25; Brazil 23.
Asbestos, crude	4,127	1,008	9	Canada 946; Mexico 53.
Boron materials: Oxide and acid	13	14	12	West Germany 2.
Cement	151,905	195,784	2,237	El Salvador 114,624; Mexico 50,219; Colombia 14,362.
Clays and clay products:				
Crude clays	5,267	4,957	3,745	United Kingdom 866.
Products:				
Refractory including nonclay brick	4,417	7,232	3,813	Mexico 2,207; Canada 433.
Nonrefractory	2,143	2,102	35	Italy 1,608; Nicaragua 174.
Diatomite and other infusorial earth	832	718	258	Mexico 459.
Fertilizer materials:				
Crude:				
Nitrogenous	90	194	45	Chile 110.
Phosphatic	179	81	81	
Manufactured:				
Nitrogenous	125,459	103,273	33,277	Netherlands 29,536; West Germany 20,807.
Phosphatic	21,931	38,423	31,281	Netherlands 7,100.
Potassic	4,733	12,091	12,054	Israel 36.
Other including mixed	57,730	71,218	18,698	El Salvador 34,956; Costa Rica 8,254.
Graphite, natural	49	48	14	Mexico 34.
Gypsum and plasters	59	46	32	Mexico 14.
Lime	825	2,452	199	Mexico 2,196.
Mica:				
Crude including splittings and waste	12	10	3	France 7.
Worked including agglomerated splittings value, thousands	$1	$6	$3	West Germany $2.
Pigments, mineral, crude	11	--		
Precious and semiprecious stones value, thousands	$12	$7	$2	Mexico $3; Switzerland $2.
Salt and brines	19,947	18,827	52	El Salvador 16,817.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	10,043	7,796	423	Nicaragua 5,294; Poland 704.
Soda ash	9,685	14,680	11,517	Bulgaria 1,576.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	290	255	--	Mexico 177; Costa Rica 78.
Worked	48	3	--	Mexico 2.
Gravel and crushed rock	159	94	31	Mexico 54.
Quartz and quartzite	665	420	40	United Kingdom 315; Mexico 64.
Calcareous stone	764	517	--	Mexico 330; El Salvador 109.
Sulfur:				
Elemental, all forms	11,479	4,880	42	Netherlands Antilles 3,397; Costa Rica 1,380.
Sulfuric acid, oleum	798	722	69	El Salvador 459; Mexico 179.
Talc, steatite, soapstone, pyrophyllite	294	632	507	China, mainland 71; Hong Kong 20.
Other:				
Crude	74	141	--	All from El Salvador.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	12,826	11,309	447	El Salvador 6,610; West Germany 2,233.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt, natural	--	2	2	
Coal, all grades including briquets	134	164	163	Honduras 1.

Table 9.—Guatemala: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Coke and semicoke	686	803	549	Mexico 252.
Hydrogen, helium, rare gases	4,171	4,215	870	Colombia 1,562; Mexico 874; Venezuela 332.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	6,027	425	--	Mainly from Venezuela.
Refinery products:				
Gasoline ---do---	1,227	1,665	1	Netherlands Antilles 1,318; Canada 210.
Kerosine ---do---	178	195	18	Bahamas 117; Netherlands Antilles 49.
Distillate fuel oil ---do---	2,207	2,373	2	Bahamas 1,084; Netherlands Antilles 912.
Lubricants ---do---	119	140	63	El Salvador 25; Netherlands Antilles 22.
Mineral jelly and wax ---do---	48	76	62	Japan 6; Mexico 4.
Liquefied petroleum gas ---do---	412	524	--	Venezuela 277; Mexico 183.
Unspecified ---do---	119	83	1	El Salvador 40.
Mineral tar and other coal-, petroleum-, and gas-derived crude chemicals	9,311	10,688	6,788	Netherlands Antilles 1,140; Nicaragua 1,007.

HONDURAS

In 1980, Honduras experienced a sharp downturn in economic growth. A severe shortage of credit, disappointing export performance, soaring petroleum import costs, and most of all lack of investor confidence were the main factors behind the decline. In real terms the GDP grew 2.5% to an estimated $2.6 billion,[6] compared with the 7.8% growth in 1979. Inflation continued its upward trend, which according to the consumer price index on December 31, 1980, was 10% higher than in 1979. Imports grew 23% to $1.3 billion in 1980, of which petroleum imports registered another increase from $113 million in 1979 to $171 million in 1980.

In recent years, the mining industry has contributed about 3% of the country's GDP. The underground El Mochito precious and base metal mine is by far the most important mining operation in Honduras, accounting for about 90% of the total precious metal and 100% of the lead-zinc production. Rosario Resources Corp., acquired by AMAX Inc., on April 10, 1980, operated the mine, which produced silver, gold, lead, zinc, and cadmium. In 1980, the El Mochito produced 1.7 million troy ounces of silver, 1,465 troy ounces of gold, 14,677 tons of lead, and 17,666 tons of zinc.

The production of cadmium had not been released but is estimated at about 300 tons. El Mochito is being expanded from a current level of approximately 1,100 tons of ore processed per day to 2,500 tons per day scheduled for 1983. Most current production is from the main ore body, which at depth is declining in tonnage and grade.

During 1980, production began from the nearby San Juan ore body, a large lower grade deposit that must be mined at significantly larger tonnages with more mechanization for a lower unit cost. Overall reserves at El Mochito at yearend 1980 were approximately 8 million tons, grading per ton 4.0 ounces of silver, 0.002 ounce of gold, 4.2% lead, 8.0% zinc, and 0.5% copper. A previous year's statement included 0.47% cadmium per ton.

Other metal mines include the Tatumbla Mine, a gold-silver property operated by Alianza Industrial S.A. Honduras also produced other metallic products, including antimony and cadmium, which since 1973 have been at a rate of production of 100 tons and 200 to 300 tons of contained metal per year, respectively.

As part of the mining of a large iron ore deposit in the Agalteca region, a metallurgical project is being planned as a joint Honduran-Mexican venture. The plant is scheduled to be constructed over 3 years at an estimated cost of $95 million. Out of a proposed annual production of 100,000 tons of steel, 50% is intended for domestic consumption, and the other 50%, for export.

Kawasaki Heavy Industries Ltd. was awarded a $60 million contract from Industria Cementera Hondureña S.A. to build a new 1,800-ton-per-day plant at Piedras Azules, 120 kilometers from Tegucigalpa, the capital. The plant is to go onstream by mid-1981, with its pozzolan cement to supply the Cajón area where construction of a dam is to begin. Output is to be 1,200 tons per day of clinker mixed with 600 tons of pozzolan.

Cementos de Honduras, S.A., a privately-owned company, will expand its Rio Bijao plant near the town of San Pedro Sula to a 2,000-ton-per-day production capacity. The expansion project has been awarded to F. L. Smith & Co., A/S, of Copenhagen, Denmark.

In March, the World Bank approved a $125 million lending operation to assist in the financing of the El Cajón hydroelectric power project estimated to cost $583 million. The lending operation will include a $105 million World Bank Loan to Empresa Nacional de Energía Electrica (ENEE) and a $20 million International Development Association (IDA) credit to the Republic of Honduras.

The 292-megawatt El Cajón hydroelectric plant is to be located approximately 80 kilometers southeast of Honduras' major industrial center, San Pedro Sula.

In June 1980, the World Bank approved a $3 million loan to help finance a petroleum exploration promotion project in Honduras, which represents a first step in bank assistance to the development of the country's petroleum sector. The first wildcat of Texaco-Amerada Hess in the Caribbean Sea off Honduras was dry. The Zepher I semisubmersible drilling rig and platform is slated to drill a second wildcat in the area.

No gas or oil has been discovered to date. However, a larger deposit of coal lignite has recently been located in the western part of the country.

Table 10.—Honduras: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
METALS				
Antimony ore and concentrate, gross weight	103	--		
Iron and steel metal, all forms	1,571	2,701	--	Costa Rica 1,677; Guatemala 919.
Lead:				
Ore and concentrate, gross weight	35,244	33,656	23,406	United Kingdom 10,250.
Metal including alloys, all forms	19	31	--	All to Guatemala.
Silver:				
Ore and concentrate value, thousands	$11,574	$10,771	$7,479	United Kingdom $2,479.
Metal including alloys, unwrought and partly wrought ---do---	$219	$129	$129	
Zinc:				
Ore and concentrate, gross weight	52,716	50,491	29,991	Japan 10,000; Netherlands 5,500.
Metal including alloys, all forms	63	24	--	All to Nicaragua.
Other:				
Ores and concentrates	--	2,640	2,496	Japan 106.
Ash and residue containing nonferrous metals	26	--		
NONMETALS				
Abrasives, n.e.s.: Natural	--	4	--	All to Nicaragua.
Cement	2,279	5,059	212	Guatemala 4,209.
Clays and clay products:				
Crude clays	22	24	--	Guatemala 23.
Products including refractory brick	74	--		
Fertilizer materials:				
Crude	--	47	22	Nicaragua 17.
Manufactured	7	(1)	--	All to Costa Rica.
Gypsum and plasters	--	2	--	All to Nicaragua.
Lime	7	--		
Precious and semiprecious stones value, thousands	--	$4	$4	
Salt	117	62	--	Nicaragua 17.
Stone, sand and gravel: Dimension stone, crude and partly worked	20	16	9	Nicaragua 7.

See footnotes at end of table.

Table 10.—Honduras: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	63	206	--	Guatemala 191.
MINERAL FUELS AND RELATED MATERIALS				
Hydrogen and rare gases	--	1	NA	NA.
Petroleum refinery products:				
Residual fuel oil thousand 42-gallon barrels	53	--		
Lubricants do	(2)	--		

[1]Unreported quantity valued at $1,000.
[2]Less than 1/2 unit.

Table 11.—Honduras: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	1,490	984	415	Nicaragua 210; Austria 81.
Copper:				
Sulfate	67	NA	NA	NA.
Metal including alloys, all forms	200	211	60	Mexico 86; Japan 39.
Iron and steel metal:				
Scrap	1	--		
Other	68,521	65,892	17,160	Japan 10,576; Brazil 6,457.
Lead metal including alloys, all forms	140	374	92	Mexico 200; Peru 50.
Nickel metal including alloys, all forms	3	1	1	
Silver metal including alloys, unwrought and partly wrought[1] value, thousands	$3	$4	$4	
Tin metal including alloys, all forms	48	66	16	Peru 20; Denmark 10; Mexico 10.
Zinc metal including alloys, all forms	824	1,776	48	Mexico 1,043; Argentina 251; Belgium-Luxembourg 202.
Other:				
Ores and concentrates	28	42	39	Costa Rica 3.
Metals including alloys, all forms	8	7	7	
NONMETALS				
Abrasives, n.e.s.:				
Natural	r24	14	14	
Grinding and polishing wheels and stones	73	70	13	Czechoslovakia 14; West Germany 10.
Asbestos, crude	1,185	2,062	--	All from Canada.
Cement	1,862	27,085	59	Colombia 24,240.
Clays and clay products:				
Crude: Kaolin and other clays or earths	9,644	12,477	2,933	Guatemala 9,511.
Products including nonclay refractory brick	2,583	2,608	887	Nicaragua 674; Guatemala 184; Italy 182.
Diamond, industrial value	$12,051	--		
Diatomite and other infusorial earth	409	262	87	Mexico 166.
Fertilizer materials:				
Crude, phosphatic	41	(2)	NA	NA.
Manufactured	80,043	50,615	26,149	West Germany 13,003; Netherlands 6,613.
Graphite, natural kilograms	120	(3)	NA	NA.
Gypsum and plasters	30	29	29	
Lime	1,515	1,822	28	United Kingdom 1,532; Guatemala 89.
Mica, worked kilograms	360	1,000	1,000	
Pigments, mineral, natural, crude	(4)	20	--	All from Mexico.
Precious and semiprecious stones except diamond value, thousands	$6	$12	$1	Switzerland $5.
Salt	396	210	150	Canada 59.

See footnotes at end of table.

Table 11.—Honduras: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s.:				
Caustic potash	9	--		
Caustic soda	4,342	4,927	500	Nicaragua 4,079; Spain 307.
Soda ash	9,648	1,034	25	Bulgaria 508; East Germany 429.
Stone, sand and gravel:				
Dimension stone, all forms	106	113	8	Guatemala 94.
Sand including ground quartz	77	--		
Other stone	19	24	17	Belgium-Luxembourg 3; West Germany 3.
Quartz and quartzite	--	160	146	West Germany 14.
Calcareous stone	--	5,894	3	Nicaragua 5,891.
Sulfur:				
Elemental, all forms	23	13	--	Belgium-Luxembourg 8; East Germany 5.
Sulfuric acid, oleum	380	287	90	Netherlands 91; Guatemala 39.
Talc, natural steatite	148	152	101	Italy 24; Costa Rica 22.
Other:				
Crude	98	--		
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	4,036	1,201	128	Costa Rica 724; Mexico 202.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt, natural	--	1	1	
Coal and coke including briquets	143	179	128	Belgium-Luxembourg 32; Guatemala 17.
Hydrogen and rare gases	70	1,097	357	Belgium-Luxembourg 407; Nicaragua 202.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	3,158	3,009	--	Venezuela 2,399; Trinidad and Tobago 610.
Refinery products:				
Gasoline do	126	159	(4)	Trinidad and Tobago 132; Nicaragua 27.
Kerosine and jet fuel do	50	73	1	Trinidad and Tobago 50; Nicaragua 22.
Distillate fuel oil do	387	438	--	Trinidad and Tobago 433.
Residual fuel oil do	39	200	(4)	Trinidad and Tobago 114; Venezuela 85.[1]
Lubricants do	61	77	56	Jamaica 15.
Mineral jelly and wax do	15	17	1	Japan 11; China, mainland 4.
Liquefied petroleum gas do	40	63	(4)	Venezuela 60.
Unspecified do	93	81	1	Netherlands Antilles 49; Nicaragua 30.
Total do	811	1,108		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5,420	6,053	2,735	France 1,920; Netherlands 1,047.

r Revised. NA Not available.
[1] Includes platinum-group metals.
[2] Excludes unreported quantity of crude, phosphatic fertilizer materials, valued at $1,000.
[3] Excludes unreported quantity of natural graphite valued at $1,000.
[4] Less than 1/2 unit.

NICARAGUA

Following the civil war, the country continued to suffer the effects of war damage and reduced economic output. Capital flight was estimated at $1.8 billion[7] or more than the 1978 GDP. The GDP dropped in 1979 by 26%, and recovery is likely to be slow, considering the damage and disruption to industry, agriculture, trade, and infrastructure. The inflation rate is running at about 40%.

The "reactivation" plan published at the beginning of 1980 provides for a growth of 22.5% in GDP, unemployment of 19%, and lowered inflation to about 15%. An added boost to the economy will come from participation in the concessionary oil sales arrangement provided by Mexico and Venezuela. Venezuela has agreed to allow Nicaragua to purchase 27,000 barrels of oil per day at a 10% discount on world prices if such portion is invested in local energy development projects. Venezuela's cooperation plan reported in January also included technical assistance.

In April, as part of a cooperation agreement reached during the visit to Managua by officials of the Mexican Government, Mexico will supply 7,500 barrels of oil per day, together with technical assistance from PEMEX to the Corporacion Nicaraguense de Minas e Hidrocarburos CONDEMINAH on training in petroleum exploration and production.

In the mineral sector, the most significant development was the nationalization, in November 1979, of the entire domestic mining industry. The Government created CONDEMINAH, which will manage all mining activities in Nicaragua and will also be responsible for petroleum policy. CONDEMINAH will be advised and coordinated by IRENA (Institute of National Resources and Environment).

In August, CONDEMINAH reported that work on a new petroleum policy was proceeding satisfactorily and would be ready for approval by the Council of State. CONDEMINAH also reported that the necessary audits for the compensation of the expropriated gold mines were moving slowly owing to the great task of evaluating the complex and diversified inventory. Nevertheless, CONDEMINAH believed that the Government would soon be ready to begin negotiations with the expropriated companies. On June 28, the U.S. Senate approved the appropriation of the 1980 $75 million aid package to Nicaragua. The aid includes $5 million in grants and $70 million in loans for purchase of U.S. goods. In August, the Government was to take control of imports and the distribution of fuel, according to news agency reports. Crude oil imports are to be handled by Petronic, the state company.

Since the nationalization of the Nicaraguan mining industry, little information on developments within this sector has been made available to the public. The limited mineral output has been dominated by the production of the precious metals gold and silver, largely in Zelaya Province, from mines operated by Rosario Mining of Nicaragua Inc., before nationalization. CONDEMINAH is reported to be interested in expanding gold production in the country, the value of which rose from $7.9 million in 1979 to 23.4 million in 1980. Nicaragua currently is producing about 5,000 troy ounces of gold per month. Silver output declined 58% in 1980 compared with that in 1979. Production of hydraulic cement increased 44% in 1980 compared with 1979 output.

Oil exploration in Nicaragua's offshore concession areas has been at a standstill because of the political unrest in the country. However, renewed activity is expected in the near future once companies such as Union Oil of California, Oceanic Exploration of Denver, and others renegotiate their exploration leases.

Because of oil price increases and the lack of success in discovering oil and natural gas, the Government was emphasizing the development of alternative domestic sources of energy. Some of the projects under consideration included the $36 million Austrias hydroelectric project, the construction of which was expected to be bid in September 1980, and a $18 million geothermal field feasibility study that was also expected to be bid in September. These projects were being financed by the IDB, which may also be requested to finance the $47 million Larreynaga hydroelectric project (complementary to Austrias) and the more ambitious $483 million Copalar hydroelectric project, scheduled for a later period.

Progress continued on the second stage of the Momotombo geothermal project at Lake Managua being undertaken by Empresa Nacional de Luz y Fuerza (Enaluf). The 35-megawatt geothermal plant was expected to become operational in 1982, but startup was likely to be delayed because of the political situation.

Table 12.—Nicaragua: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, semimanufactures	802	147	--	Honduras 96; Costa Rica 21; Guatemala 20.
Copper:				
Ore and concentrate	2	--		
Metal including alloys, unwrought	--	81	--	All to El Salvador.
Iron and steel:				
Ore and concentrate	39	37	--	Do.
Metal:				
Scrap	2,611	3,387	--	El Salvador 3,310; Mexico 40.
Semimanufactures	10,992	2,414	--	Costa Rica 1,003; Honduras 546; El Salvador 367.
Lead:				
Ore and concentrate	1,915	39	39	
Metal including alloys, semimanufactures	3	--		
Silver metal including alloys, unwrought and partly wrought value, thousands	$2,332	$1,511	$1,394	Canada $117.
Zinc:				
Ore and concentrate	11,040	--		
Metal including alloys, unwrought	2	--		
Other:				
Ores and concentrates	--	3	2	NA.
Metals including alloys:				
Scrap	635	423	--	West Germany 307; El Salvador 76.
Other	--	29	--	All to West Germany.
NONMETALS				
Cement	10,782	19,024	--	Honduras 18,658; Guatemala 366.
Clay and clay products:				
Crude clays	317	18	--	All to Costa Rica.
Products:				
Refractory including nonclay brick	2,650	1,113	--	Costa Rica 776; El Salvador 187; Honduras 104.
Nonrefractory	1,271	1,255	--	Costa Rica 632; Guatemala 277; Honduras 190.
Diatomite and other infusorial earth	81	20	--	Costa Rica 13.
Feldspar and related materials	5	--		
Fertilizer materials, manufactured:				
Nitrogeneous	63	7	--	All to Honduras.
Phosphatic	28	23	--	Do.
Potassic	--	9	--	Do.
Other including mixed	189	80	--	Do.
Gypsum and plasters	18,081	13,341	--	All to Costa Rica.
Lime	539	630	--	Do.
Salt	3,594	4,904	--	Do.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	29,618	15,199	--	Guatemala 5,067; El Salvador 4,577; Costa Rica 3,714.
Soda ash	--	13	--	All to Costa Rica.
Stone, sand and gravel:				
Dimension stone, worked	16	50	--	Guatemala 38.
Quartz and quartzite	20	--		
Limestone excluding dimension	NA	194	--	Costa Rica 157; Honduras 37.
Sulfur: Sulfuric acid, oleum	6	--		
MINERAL FUELS AND RELATED MATERIALS				
Hydrogen, helium, rare gases	842	718	--	Costa Rica 296; Honduras 188; Guatemala 116.
Petroleum refinery products:				
Gasoline, 42-gallon barrels	--	272	--	Guatemala 170; Honduras 102.
Kerosine, do.	24,041	27,768	--	Honduras 13,284; Costa Rica 6,727; El Salvador 3,991.
Lubricants, do.	--	43,736	--	Guatemala 16,492; El Salvador 12,306; Honduras 9,457.
Other:				
Liquefied petroleum gas, do.	1,984	3,248	--	Honduras 2,958; Costa Rica 290.
Unspecified, do.	37,437	47,125	--	Honduras 43,888; Costa Rica 3,229.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	994	1,049	--	Guatemala 659; El Salvador 195; Costa Rica 194.

NA Not available.

Table 13.—Nicaragua: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Unwrought	536	163	163	
Semimanufactures	805	309	35	El Salvador 163; West Germany 32; Austria 28.
Copper:				
Sulfate	34	NA	NA	NA.
Metal including alloys:				
Unwrought	--	1	1	
Semimanufactures	87	43	15	Costa Rica 15; Belgium-Luxembourg 6.
Iron and steel metal:				
Pig iron	6	19	--	All from Honduras.
Ferroalloys	2	13	5	Mexico 8.
Steel, primary forms	7,123	931	11	Mexico 583; El Salvador 334.
Scrap	75	--		
Semimanufactures	58,406	21,357	1,813	Costa Rica 6,273; Japan 4,881; Belgium-Luxembourg 3,653.
Lead metal including alloys:				
Unwrought	231	198	10	Mexico 167; Guatemala 10.
Semimanufactures	2	13	--	Costa Rica 7; Guatemala 5.
Nickel metal including alloys, all forms value, thousands	$9	$6	$5	West Germany $1.
Silver metal including alloys, unwrought and partly wrought do	--	$17	$17	
Tin metal including alloys:				
Unwrought	10	9	1	United Kingdom 6; West Germany 2.
Semimanufactures	5	1	1	
Zinc metal including alloys:				
Unwrought	555	236	--	Canada 130; Mexico 100.
Semimanufactures	123	33	26	United Kingdom 4; Canada 3.
Other metals including alloys, all forms value, thousands	NA	$11,142	$3,946	Costa Rica $1,795; El Salvador $1,341; Colombia $603.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	7	2	1	NA.
Grinding and polishing wheels and stones	NA	100	3	Costa Rica 80; West Germany 10.
Asbestos, crude	1,362	2	--	All from Guatemala.
Boron materials: Oxide and acid	15	5	(1)	Netherlands 2; Spain 1.
Cement	3,548	177	5	Japan 102; Belgium-Luxembourg 64.
Clays and clay products:				
Crude clays	2,559	1,346	625	United Kingdom 503; Mexico 195.
Clay products:				
Refractory including nonclay brick	582	403	166	Mexico 117; Italy 61; Guatemala 42.
Nonrefractory	414	5	4	Mexico 1.
Diatomite and other infusorial earth	543	344	285	Mexico 52; United Kingdom 6.
Feldspar and related materials	727	--		
Fertilizer materials:				
Crude	2	--		
Manufactured:				
Nitrogenous	65,924	13,995	38	Venezuela 9,280; Netherlands 4,436.
Phosphatic	18,425	14,230	14,226	Costa Rica 4.
Potassic	8,525	18	18	
Other including mixed	15,069	2,864	48	Costa Rica 2,815.
Graphite, natural	9	14	--	All from Mexico.
Gypsum and plasters	223	171	58	Guatemala 103; West Germany 9.
Lime	552	1	--	All from United Kingdom.
Mica, all forms value, thousands	(1)	$3	$2	Japan $1.
Pigments, mineral, natural, crude	NA	2	2	
Precious and semiprecious stones value, thousands	$1	$1	--	All from Switzerland.
Salt	30,043	16,513	83	Mexico 16,400; El Salvador 28.
Sodium and potassium compounds, n.e.s.:				
Caustic potash	16	--		
Caustic soda	2,795	768	3	Romania 758; West Germany 7.
Soda ash	759	524	40	West Germany 398; Denmark 74.
Stone, sand and gravel	697	527	44	Costa Rica 406; Mexico 42; Guatemala 23.
Sulfur:				
Elemental, all forms	280	381	--	West Germany 380.
Sulfuric acid, oleum	726	501	120	El Salvador 220; Costa Rica 84; Panama 38.
Talc	382	160	62	Italy 35; China, mainland 20; Spain 18.
Other, crude	670	--		

See footnotes at end of table.

Table 13.—Nicaragua: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	3	--		
Coal and coke	109	28	14	Mexico 14.
Hydrogen, helium, rare gases	364	102	19	West Germany 80.
Petroleum and refinery products:				
Crude, thousand 42-gallon barrels	3,927	3,074	219	Venezuela 2,855.
Refinery products:				
Gasoline, 42-gallon barrels	357,109	120,373	1,931	Netherlands Antilles 98,545; Panama 16,452.
Kerosine, do.	12,509	29,923	6,022	Netherlands Antilles 20,964; Panama 2,643.
Distillate fuel oil, do.	1,256,906	6,155	104	Panama 6,051.
Residual fuel oil, do.	NA	186,380	3,317	Panama 150,076; Netherlands Antilles 32,141.
Lubricants, do.	111,265	27,846	12,950	El Salvador 7,105; Netherlands Antilles 4,088.
Other:				
Liquefied petroleum gas, do.	3,260	3,028	267	Guatemala 1,380; El Salvador 1,357.
Mineral jelly and wax, do.	6,965	7,240	1,401	Japan 2,219; China, mainland 1,794; Spain 409.
Unspecified, do.	766	826	811	Panama 15.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	NA	2,771	1,439	Netherlands Antilles 1,161; Honduras 147.

NA Not available.
[1]Less than 1/2 unit.

PANAMA

The Panamanian GDP grew by 7% in real terms in 1979 and is estimated to have grown by almost 5% in 1980. The improvement in economic performance was derived from increased investment and continued strong growth in the construction industry. Manufacturing and electric power output were also growing rapidly. The GDP at current prices reached an estimated $3.4 billion[8] in 1980. Inflation was 14% to 15% in 1980. Unemployment continued at a high level and was expected to remain a serious problem.

The trade deficit was estimated at $870 million in 1980, a 13% increase over that of 1979. Petroleum products exported increased 37% by value and 4% by volume. Petroleum imports were expected to decrease in the future when most of Panama's electric power generation would be by hydroelectric resources now being developed.

The mineral industry of Panamá was of minor significance to the country's economy. The main activity in this sector besides the refining of petroleum was concentrated in mining small quantities of gold, manganese, salt, limestone, sand and gravel, cement, and clay.

Large inflows of foreign capital were expected as a result of the large development projects now underway or planned, including hydroelectric projects, the transisthmus oil pipeline, and the Cerro Colorado copper project.

Two projects of great economic and commercial significance, the transisthmus oil pipeline and the Cerro Colorado copper project, are likely to be initiated in 1981-82. The implementation of the $250 million pipeline project awaited final approval by Panama's legislative body. The 78-mile-long, 36-inch-diameter crude oil pipeline is to move as much as 700,000 barrels per day of crude from the Pacific to the Atlantic. The pipeline will originate at Puerto Armuelles on the Pacific side and extend north and east to the Atlantic side at Chiriqui Grande. A contract for the design and construction of the pipeline was expected to be awarded in early 1981 by

Petroterminal Panama, S.A., a joint venture of the Government of Panamá working through Corporación Finaciera Nacional (COFINA), its national finance corporation; Northville Industries Corp. of Melville, N.Y.; and CBI Industries of Oak Brook, Ill. The pipeline would substantially cut transportation costs for crude moving from Alaska to the gulf coast and east coast refineries. Five hundred thousand barrels per day of Alaskan crude is moving through the Panamá Canal via tankers. Northville Industries Corp., which operates the transfer terminal for crude transiting the canal, reported that a consortium of banks will finance the venture for themselves and CBI Industries Inc. Final contracts were being negotiated. The three oil companies that move the bulk of crude oil through the canal, Exxon Co., Atlantic Richfield Co., and Sohio Petroleum Co., have agreed in principle to use the pipeline but have not yet signed contracts.

Contracts will also be made to construct 2.5 million barrels of oil storage and two offshore tanker loading structures on the Atlantic. Two pump stations will be built. The pipeline will require 16 months to build and should be operational in late 1982. A road to be built adjacent to the pipeline will open up a new area of Panamá to vehicular traffic, and hence to economic development. Income taxes, royalties, and interest income accruing to the country because of the project was estimated at $74 million per year.

When the proposed Cerro Colorado copper project becomes a reality in the future, it is expected to transform the mineral industry of Panamá. Cerro Colorado copper deposit is one of the world's five largest with 1.4 billion metric tons of ore reserves that contains 0.78% copper, 0.01% molybdenum, 5.1 grams of silver, and 0.08 gram of gold per ton. A joint venture by the state-owned Corporación de Desarrollo Minero Cerro Colorado (CODEMIN) and Texasgulf Inc. to develop the deposits in Chiriqui Province, was severely affected by world inflation, and in early 1980, Texasgulf sold its 20% interest in the project to the Río Tinto-Zinc Corp. Ltd. (RTZ) of England for $5.5 million. This sum represented Texasgulf's expenditure on the project. In June 1980, RTZ signed a contract with Empresa de Cobre Cerro Colorado S.A. stipulating a 49% participation, the remainder to be held by CODEMIN.

RTZ is to carry out a work program early in 1981 to review the feasibility of the project, the cost of which is estimated at $2.0 billion. A final decision on whether to proceed with the development of the project was set for July 1981. Texasgulf, which retained an option enabling it to acquire from RTZ an interest of about 15% in the project, estimated that a price of between $1.50 and $2.00 per pound of copper would be necessary to yield an adequate return on the large investment.

Other smaller mineral-related projects involve an increase in the production capacity of Cemento Panamá and a $12 million investment of Panalac S.A., the country's only steelmaker, which was in the process of establishing a 70,000-ton-per-year ministeelworks at Panamá City, scheduled for startup in April 1981.

Petroleum and natural gas exploration continued in 1980, mostly in the Gulf of Panamá, an area largely unexplored. Results obtained in the gulf concession areas were unfavorable to date, although the United States-Panamanian Sossa Petróleo announced, in 1980, the discovery of an oil deposit in the Darien Strait. Plans to start commercial production were underway. An oil strike was also reported off the San Blas Island along the Caribbean coast, east of Panamá.

The World Bank announced on March 19, 1981, the approval of a $6.5 million loan to assist the Government in accelerating petroleum exploration, improving energy planning, and investigating the potential for development of energy alternatives. Panamá has currently no petroleum production, although the existence of tar pits and gas encountered in water holes has long suggested the possibility of petroleum resources. The project also includes investigation of the coal potential in the Boca del Ratón region and geothermal studies of the Cerro del Pando site.

Mexico and Venezuela are to supply Panamá with 12,000 barrels per day of oil under their special agreement for assisting countries of Central America and the Caribbean. This will enable Panamá to retain 30% of the purchase price of $300 million per year for application to projects in the energy sector.

The Government was following a two-part strategy for satisfying Panamá's increasing demand for electricity. The first part in-

volves the development of hydroelectric facilities to replace imported oil. The 264-megawatt Changuinola I hydroelectric project in western Panamá has been identified as the next facility to be developed. This $700 million project has recently been incorporated into the Cerro Colorado copper project. A Canadian firm, Acrees International Ltd., was also studying the feasibility of a 120-megawatt hydroelectric plant on the Río Tabasara, which will be developed to take the place of the Changuinola I project in the natural grid if the Cerro Colorado project proceeds. The second part of the Government strategy involves the extension of electricity to new users, particularly in the rural areas of the country.

Table 14.—Panama: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1979	Destinations, 1979	
		United States	Other (principal)
METALS			
Aluminum metal including alloys, all forms	577	93	Costa Rica 453; Honduras 29.
Copper metal including alloys, all forms	40	40	
Iron and steel metal:			
Scrap	900	--	West Germany 865; Costa Rica 35.
Steel, primary forms	181	--	All to Costa Rica.
Semimanufactures:			
Bars, rods, angles, shapes, sections	205	--	Do.
Universals, plates, sheets	12	--	Costa Rica 10.
Lead metal including alloys, all forms	688	461	Ecuador 120; Guatemala 70.
Other: Metals including alloys, scrap	1,835	1,218	Colombia 400; West Germany 91; Japan 73.
NONMETALS			
Cement	93,620	25,100	Colombia 56,695; Belize 3,875.
Clay products, nonrefractory	101	1	Costa Rica 94; El Salvador 6.
Sulfur, elemental, colloidal	2	--	All to Costa Rica.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Lubricants, 42-gallon barrels	28	--	All to Nicaragua.
Unspecified, do.	165	--	Costa Rica 150.

[1]Data for 1978 are not available.

Table 15.—Panama: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1977	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	1,526	3,219	1,707	Costa Rica 377; Austria 234; Belgium-Luxembourg 187.
Copper metal including alloys, all forms	318	785	72	Chile 444; Italy 95; Costa Rica 48.
Iron and steel metal:				
Scrap	--	263	223	NA.
Pig iron	--	15,447	3,266	Netherlands 5,152; Canada 3,897; Chile 2,000.
Ferroalloys	--	116	26	Brazil 60; Chile 30.
Steel, primary forms	--	8,382	2,689	Canada 1,973; Costa Rica 1,553; Japan 1,116.
Semimanufactures:				
Bars, rods, angles, shapes, sections	11,871	8,094	921	Japan 2,890; Brazil 1,970; Belgium-Luxembourg 1,386.
Universals, plates, sheets	8,390	30,947	3,880	Japan 15,012; Netherlands 3,410; Costa Rica 2,778.
Hoop and strip	18,029	1,558	21	Japan 1,509.
Rails and accessories	348	691	55	Italy 635.
Wire	4,114	6,363	307	Brazil 1,269; France 1,039; Japan 916.
Tubes, pipes, fittings	6,236	--	--	
Castings and forgings, rough	3,121	96	88	Colombia 5; Sweden 3.
Lead metal including alloys, all forms	347	75	32	Costa Rica 28; Denmark 15.
Nickel metal including alloys, all forms	--	2	1	Switzerland 1.
Silver metal including alloys, unwrought and partly wrought value, thousands	$1,533	$33	$25	France $6.
Tin metal including alloys, all forms	--	15	11	Bolivia 2.

See footnotes at end of table.

Table 15.—Panama: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Zinc oxides and peroxides	--	33	2	Mexico 12; Peru 12; Netherlands 4.
Other metals including alloys:				
Scrap	--	66	62	NA.
Unwrought and semimanufactures	--	22	17	Japan 5.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	--	22	8	Brazil 6; United Kingodm 5.
Asbestos, crude	532	445	176	Guatemala 40.
Cement	3,561	4,847	17	Colombia 2,364; Denmark 1,446.
Clays and clay products:				
Crude clays	1,094	870	485	El Salvador 153; Nicaragua 56; Peru 54.
Clay products:				
Refractory including nonclay brick	799	697	662	Guatemala 9; West Germany 8.
Nonrefractory	--	541	13	Italy 349; West Germany 31.
Diamond, industrial value, thousands	--	$1	$1	
Diatomite and other infusorial earths	--	399	33	Mexico 366.
Feldspar and fluorspar	--	117	77	Guatemala 40.
Fertilizer materials, manufactured:				
Nitrogenous	15,583	29,187	11,991	West Germany 10,249; Costa Rica 3,979.
Phosphatic	10,855	2,000	1,300	Netherlands 398; Costa Rica 300.
Potassic	1,063	8,743	817	West Germany 7,924.
Other including mixed	40,091	30,947	7,468	Costa Rica 23,180; Netherlands 248.
Graphite, natural	--	4	4	
Gypsum and plasters	--	16,204	169	Dominican Republic 9,000; Jamaica 7,000.
Lime	1,169	2,284	27	Peru 1,028; Costa Rica 378; Canada 306.
Mica, crude including splittings and waste	--	21	21	
Pigments, mineral, crude	--	40	4	Mexico 36.
Precious and semiprecious stones, except diamond value, thousands	$1,942	$283	$173	United Kingdom $27; Hong Kong $12.
Salt	725	688	211	United Kingdom 282; Netherlands 175.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	2,040	2,470	2,054	France 125; United Kingdom 114; West Germany 101.
Soda ash	NA	116	20	West Germany 40; Colombia 36; France 20.
Unspecified	5,194	--		
Stone, sand and gravel:				
Dimension stone, crude	NA	766	106	Canada 336; Italy 320.
Limestone except dimension	NA	1,721	26	Costa Rica 1,605; Colombia 90.
Quartz and quartzite	NA	79	79	
Sand excluding metal-bearing	NA	4,382	4,368	Italy 14.
Sulfur, elemental:				
Other than colloidal	--	10	--	All from West Germany.
Colloidal	--	56	56	
Talc	--	488	407	China, mainland 55; Colombia 25.
Other: Halogens	--	3	3	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	1	1	
Coal, all grades including briquets	--	73	72	Costa Rica 1.
Coke and semicoke	--	143	63	Colombia 80.
Petroleum and refinery products:				
Crude thousand 42-gallon barrels	r20,499	19,547	--	Ecuador 11,763; Saudi Arabia 4,504; Venezuela 3,280.
Refinery products:				
Gasoline do	182	280	(2)	Trinidad and Tobago 241; Venezuela 27.
Kerosine do	--	31	4	Venezuela 25.
Distillate fuel oil do	980	(2)	--	All from West Germany.
Residual fuel oil do	75	5	(2)	Venezuela 5.
Lubricants do	222	77	42	Netherlands Antilles 15; Jamaica 14.
Other:				
Liquefied petroleum gas do	r94	227	(2)	Trinidad and Tobago 170; Venezuela 56.
Mineral jelly and wax do	r15	15	4	Japan 6; China, mainland 2.
Unspecified do	r3	3	2	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	738	467	39	Netherlands Antilles 416; West Germany 11.

rRevised. NA Not available.
[1]Data for 1978 are not available.
[2]Less than 1/2 unit.

[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Belizean dollars (Bz$) to U.S. dollars at the rate of Bz$2.00=US$1.00 (the average rate for 1977-79).

[3]Where necessary, values have been converted from Costa Rican colónes (c) to U.S. dollars at the rate of c8.57=US$1.00.

[4]Where necessary, values have been converted from Salvadoran colónes (c) to U.S. dollars at the rate of c2.50=US$1.00 (as of July 22, 1981).

[5]Where necessary, values have been converted from Guatemalan quetzals (q) to U.S. dollars at the rate of q1.00=US$1.00 (as of Apr. 30, 1980).

[6]Where necessary, values have been converted from Honduran lempiras (l) to U.S. dollars at the rate of l2.00=US$1.00 (since 1931).

[7]Where necessary, values have been converted from Nicaraguan cordobas (c$) to U.S. dollars at the rate of c$10.00=US$1.00 (as of Sept. 24, 1980).

[8]Where necessary, values have been converted from Panamanian balboas (b) to U.S. dollars at the rate of b1.00=US$1.00.

The Mineral Industry of Other Areas of the Far East and South Asia

By Edmond Chin and Gordon L. Kinney

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BANGLADESH[1]

Mineral production was of minor importance to the country's economy, and Bangladesh was not a ranking world producer of any mineral commodity in 1980. Natural gas was the most important mineral exploited, and reserves were sufficient to allow a significant increase in its use. A greater proportion of the domestic heat and electrical energy needs could be filled by increased production and distribution of natural gas. Also, the export of natural gas was feasible either by pipeline to India or in the form of liquefied natural gas (LNG). Some nonmetallic minerals could be developed, as well as coal and peat, given sufficient capital investment.

Bangladesh's strongly agricultural economy made fair progress in 1979-80.[2] The major harvest of November-December 1979 turned out to be better than had been anticipated after an early drought left poor planting conditions. Secondary crops (harvested in February-March 1980 and June-July 1980) were excellent. There were prospects for a record harvest in fiscal year 1980-81.

Gross domestic product (GDP) at current prices rose to an estimated $9.9 billion[3] in fiscal year 1979-80 from a total of $9.3 billion in fiscal year 1978-79.[4] The population continued to increase at 2.8% per year, a rate nearly equal to the real growth in GDP, resulting in a very slow growth in per capita income, which was one of the lowest in the world for a large country.

Small sectors of the overall economy have done relatively well, such as construction, power and gas, and industry. Currently important and larger sectors—agriculture and housing—have done relatively poorly in recent years, not keeping pace with the overall average growth rate.

Bangladesh entered the decade of the 1980's at about the same per capita income level as at the beginning of the 1970's, despite $5.3 billion foreign aid receipts be-

tween December 1971 and June 1979. The main reasons for the lack of economic progress included rapid population growth, constant food deficits of 1.5 to 2.0 million tons per year, limited infrastructure, low productivity, lack of raw materials, large trade deficits, and low rates of domestic saving and investment.

The high annual population increase was recognized by the Government as the basic cause underlying many of the economic problems in the already grossly crowded country. Average population density has now passed 600 persons per square kilometer, one of the highest rural densities in the world.

While nonagricultural industry contributed only 12% of the value added to GDP and employed only 11% of the labor force, its development was essential to reduce the balance of payments and unemployment. Because of noted inefficiencies of publicly owned enterprises, the need for Government funding in other sectors, and the Government's more positive attitude toward private enterprise, both domestic and foreign components of the private sector were expected to have an increasingly important role in industrial development. Discouraged after massive nationalizations between 1971 and 1974, domestic investors have been slow to accept the new Government's attitude. There were recent indications of more willingness to accept investment risk. In 1975, there were few new private investments sanctioned; in fiscal year 1976-77, there were 548 business units at $54 million investment value; in fiscal year 1978-79, 749 at $145 million; and in 1979-80, 895 at $290 million.

To encourage private investment, the Government has adopted incentives, including tax holidays, liberal depreciation, industrial parks, and reductions or exemptions in duties and tariffs. The Government particularly encouraged foreign investment in industries that were (1) export oriented, (2) based on local raw materials, and/or (3) involved high technology or capital input. In addition, incentives for foreign investment included tax exemptions on foreign loans and salaries of foreign technicians, special loan rates, special foreign exchange facilities based on exports, and a new Investment Guarantee Act of 1980. This act protects repatriation of profits, capital, royalties, and many usual fees. The act states that private industries should not be nationalized, but if nationalization becomes necessary, there was a guarantee of prompt and fair payment.

In 1980, there was little left in the public sector except utilities and the jute and textile mills. Although the Government retained the jute and textile plants, it did open to private investment some specialized jute and textile operations. The Government particularly desired private investment in major sectors such as iron and steel, natural gas-based petrochemicals, cement, heavy engineering, and heavy electrical equipment. Deterrents to investments were very poor infrastructure support (electric power, transportation, communications, etc.), an unskilled labor force, an often lethargic bureaucracy, and limited domestic demand.

Electric power was the major constraint to most development in Bangladesh because of insufficient generating capacity, aging generators and equipment, and an inadequate power distribution system. There has traditionally been an excess of low-cost hydropower and natural gas-fueled generation in the east, and insufficient, expensive petroleum-fueled generation in the west.

The power shortage continued to increase during 1980. The official installed capacity was 752 megawatts in 1978 and declined to 718 megawatts in 1979.[5] The system was poorly maintained and inefficient. Transmission loss reportedly was over 27% for the system in 1980.

The Government's second 5-year plan (1980-85) called for a substantial increase in generating capacity, to a total of around 1,300 megawatts. Key powerplants were to be overhauled and the power distribution system greatly expanded.

Government measures restricted the increase in the general cost of living index to 12.4% in fiscal year 1979-80, which compared favorably with other developing countries without domestic crude oil production. During 1980, there were four devaluations of the taka totaling 12%.

Exports rose from $602 million in fiscal year 1978-79 to $719 million in fiscal year 1979-80. Minerals played virtually no part in export revenue. Jute, jute products, and tea accounted for nearly all of the value. During the last half of fiscal year 1979-80, the market for jute products dropped, causing a considerable loss of revenue. Low prices continued into the first part of fiscal year 1980-81. Fiscal year 1980-81 exports were projected at $740 million.

Imports climbed even faster than exports, from $1.27 billion in fiscal year 1977-78, to an estimated $1.60 billion in fiscal year 1978-79, and to around $2.35 billion in fiscal year 1979-80. The fiscal year 1979-80 imports included large foodgrain purchases before the Government became aware of the

good secondary harvest. The value of petroleum imports increased by 190% over that of the previous year and was 17% of total imports. In fiscal year 1980-81, food imports were expected to be much lower. The value of petroleum imports was expected to continue to increase, despite the Government's attempts to control the use of petroleum. Imports were projected at $2.7 billion for fiscal year 1980-81. The $1.6 billion trade deficit was the largest since the country was formed. As in the past, most of the deficit was to be met by foreign aid. The Government budgeted foreign aid at $1.5 billion for fiscal year 1980-81, a 15% increase over the $1.3 billion in 1979-80. The International Bank for Reconstruction and Development, Asian Development Bank, United Nations Development Program, and a number of donor nations extended financial assistance to Bangladesh.

COMMODITY REVIEW

Natural gas was by far the most valuable mineral resource being exploited in Bangladesh. During the past 69 years, a total of only 48 wells have been drilled onshore in the entire country, resulting in 8 commercial gasfields. The potential for additional development was considerable but dependent on further exploration both at known gasfields and in other favorable geologic structures that have not been drilled. Data on gas reserves have varied widely in recent years, partly because some of the gasfields have not been drilled sufficiently to make an accurate assessment of the recoverable reserve. However, over 250 billion cubic meters of recoverable gas was probably available. The country's reserves were expected to rise considerably as developmental and exploratory drilling continued.

During 1980, final arrangements were made for the start of the $164 million Bakhrabad gas development project. Initially, the Bakhrabad Gasfield was to be developed and a pipeline built for transmitting gas for distribution in Chittagong, the country's second largest city and major port.

Four new wells were to be drilled and the initial discovery well completed for production. Reserves at Bakhrabad have been set at 81 billion cubic meters by the State Minister for Petroleum. A Japanese loan will help finance this part of the project as well as the gas gathering and processing equipment. The Japan Petroleum Exploration Co. was bidding for the drilling contract. In addition to the Japanese loan, the World Bank, Kuwait, and the Organization of Petroleum Exporting Countries (OPEC) are financially involved in the project.

The main Chittagong pipeline will be 60 centimeters in diameter and approximately 200 kilometers long. The distribution system in the Chittagong area will total another 80 kilometers of 51-centimeter, 41-centimeter, and 25-centimeter distribution lines. The main consumers of the gas will be the Chittagong steel mill, a thermal powerplant, a paper mill, the Masirabad and Kalughat industrial estates, and domestic customers in the urban area. The proposed Chittagong urea fertilizer plant would also be a major consumer.

Bangladesh and Indian officials began discussing, in July 1980, the possibility of exporting natural gas by pipeline to the Calcutta area. There is a pressing need for a reliable energy source in the heavily industrialized, power short, eastern region of India. Bangladesh would supply 100 million cubic feet per day for 20 years through a 280-kilometer-long pipeline. In spite of immediate political opposition, President Zia-ur-Rahman remained in favor of the proposal. This plan would be the quickest and least expensive way of gaining substantial foreign exchange to reduce the country's chronic trade deficit.

An alternate and much more expensive plan was the construction of a natural gas liquefaction plant to export LNG. Cost of the project would be borne by the receiving country, which would then be repaid by the value of the LNG exported. Objections to this alternative included the huge capital outlay. Another was a lack of sufficient data on proved reserves at some of the potential gasfields, inasmuch as specific and detailed gasfield geology was critical to the design and economic viability of a $1 billion plus LNG complex. However, there was disagreement whether gas should be exported or used domestically to develop a wider industrial base and higher value products such as petrochemicals, steel, cement, and fertilizer.

During 1980, 2 gas deposits were added to the 10 known fields. The first discovery was in Bianibazar in Sylhet District; the Federal Republic of Germany was providing financial assistance and a U.S. firm supplied technical expertise. Gas was struck at about 3,660 meters and drilling was continuing. Drilling began in July at Dhalia near Feni in Noakhali District; gas was struck in December 1980. Preliminary estimates for

the combined gas reserves at these discoveries totaled 28 to 42 billion cubic meters (1.0 to 1.5 trillion cubic feet).

Exploration for crude petroleum continued in 1980 with a detailed aeromagnetic survey being performed over most of the country with British technical assistance. The survey attempted to identify specific areas most suitable for further exploration and drilling. The President also ordered a step-up in the rate of exploratory drilling and asked that more drilling equipment be obtained.

Bangladesh produced no crude oil during 1980 but was scheduled to begin using a small amount of light-end condensate from the Titas Gasfield during the year.

During 1980, the National Economic Council approved the construction of the country's second oil refinery. The 2-million-ton-per-year plant will cost approximately $330 million. Twenty international firms reportedly submitted tenders for the project.

The Government was planning the establishment of a direct-reduction iron plant based on imported iron ore pellets and domestic natural gas as fuel and reductant. The plant would be located in Chittagong and have an output between 500,000 and 800,000 tons per year. Chittagong Steel Mills Ltd. would also be expanded from 160,000 to 250,000 tons per year. India was expected to be the pellet supplier and was expected to buy back any direct-reduced iron that Bangladesh did not consume. At yearend, discussions were under way with Austria for the preparation of a feasibility report and financing of the $160 million project.[6]

The Government showed continuing interest in the heavy mineral beach sands off the Chittagong coast, but no development was undertaken during the year. The deposit contains ilmenite, zircon, rutile, and monazite. There were conflicting statements published during 1980 as to the quantity of the reserves and their potential value. It was stated, however, that the deposits were comparable in quality with similar occurrences in Sri Lanka, India, and Australia.

A news report from Dacca stated that the country's first nuclear power station would be built at Roopur, near Ishwardi in Pabna District. First-stage capacity would be 125 megawatts. Financing had not been arranged at yearend. This project could be several years in the discussion and planning stage before construction actually begins.

Planning for the expansion of the cement industry continued during 1980. The Geologic Survey of Bangladesh has completed a survey of the limestone deposit near Jaipurhat in Bogra District where extensive drilling has revealed an estimated 270 million tons of cement-grade limestone in a 6.5-square-kilometer area. The deposit averages 50+% CaO and 2.4% to 7.9% SiO_2. The sinking of the 550-meter shaft was to begin as soon as a contractor was chosen. The mining part of the project has escalated in cost to approximately $160 million.

A cement plant was to be built in three stages at Jaipurhat with an ultimate capacity of 3,000 tons per day clinker. The plant's first-phase construction would furnish 1,000 tons per day of clinker to the existing Chittagong grinding plant, which currently uses imported clinker. The second-phase construction would supply a planned grinding plant at Khulna. The final stage of the $120 million project would be a grinding mill at the Jaipurhat plant. The timetable for the construction of the cement plant was unclear as of yearend 1980. Bangladesh imported cement valued at approximately $21 million in 1979, but planned to be self-sufficient in cement when the project was completed.

Bangladesh had three chemical fertilizer plants operating during 1980, and one under construction and scheduled for start-up in early 1981. The Ghorasal and Fenchuganj plants produced ammonia, and urea or ammonium sulfate. The Chittagong plant produces triple superphosphate from imported raw materials.

All of these plants are one to two decades old and have been operating at 54% of combined capacity during the last decade. The Government began an overhaul program to increase the production level of the Ghorasal and Chittagong plants and also to begin a diligent preventive maintenance program at the Fenchuganj plant.

The Ashuganj plant will produce ammonia and urea from natural gas. Capacity has been cited as 528,000 tons per year of urea. Startup date was to be yearend 1980, but construction problems have delayed completion of the plant.

Two additional ammonia-urea plants were planned, one at Chittagong with the World Bank assisting in the funding and a second plant at Ghorasal to be built with Chinese aid. Both of these plants will use natural gas as fuel and raw material.

By Government design, Bangladesh was to be self-sufficient in nitrogenous fertilizer production. Phosphate and potassium raw materials were not mined locally, and no deposits suitable for mining have been identified.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities[1]

Area, commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
BANGLADESH[2]					
Cement, hydraulic[3] ____ metric tons	r157,007	r307,666	338,614	322,473	4301,493
Clays: Kaolin ____ do	1,575	3 5 4,211	36,421	38,517	37,700
Gas, natural, marketed[6] ____ million cubic feet	31,344	32,026	34,294	42,975	47,000
Iron and steel:[3]					
Crude steel (ingots only) ____ metric tons	r90,409	r107,715	116,916	126,371	4137,557
Mild steel products ____ do	r119,505	r138,140	138,277	200,415	4169,327
Nitrogen: N content of ammonia ____ do	147,700	107,100	105,100	167,132	4181,832
Petroleum refinery products:					
Gasoline ____ thousand 42-gallon barrels	468	491	523	473	4440
Jet fuel ____ do	166	60	55	60	418
Kerosine ____ do	1,985	2,021	2,289	2,529	42,499
Distillate fuel oil ____ do	1,306	1,317	746	1,005	41,168
Residual fuel oil ____ do	3,000	3,031	2,742	3,380	42,574
Lubricants ____ do	207	209	--	--	--
Other:					
Naphtha ____ do	831	832	1,174	585	4785
Unspecified ____ do	9			267	4312
Refinery fuel and losses ____ do	458	375	278	r e306	4287
Total ____ do	8,430	8,336	7,807	8,605	8,083
Salt, marine[3] ____ metric tons	549,500	345,600	785,517	674,074	700,000
Stone: Limestone, industrial[3] ____ do	r61,320	61,303	60,059	56,738	444,764
BRUNEI[2]					
Gas, natural:					
Gross ____ million cubic feet	341,343	346,011	e342,000	344,000	NA
Marketed ____ do	298,829	314,253	307,600	310,000	NA
Natural gas liquids:					
Condensate ____ thousand 42-gallon barrels	4,031	3,062	e2,900	3,000	NA
Natural gasoline ____ do	573	816	890	900	NA
Liquefied petroleum gas ____ do	144	166	175	180	NA
Total ____ do	4,748	4,044	e3,965	4,080	NA
Petroleum:					
Crude ____ do	74,424	76,650	76,535	84,000	NA
Refinery products:					
Gasoline ____ do	153	141	141	e150	NA
Distillate fuel oil ____ do	209	219	219	e210	NA
Residual fuel oil ____ do	1	1	1	e2	NA
Other ____ do	32	32	32	e37	NA
Refinery fuel and losses ____ do	1	1	1	e1	NA
Total ____ do	396	394	394	e400	NA
CHRISTMAS ISLAND[2]					
Phosphate rock ____ thousand metric tons	1,033	1,186	1,400	1,362	41,713
HONG KONG[2]					
Cement, hydraulic ____ do	765	1,029	1,236	1,279	41,489
Clays: Kaolin ____ metric tons	1,305	2,466	25,655	2,841	4748
Feldspar ____ do	2,299	3,378	3,157	742	42,974
Feldspar sand ____ do	--	--	--	--	412,964
Iron and steel:					
Iron ore and concentrate ____ do	37,058	--	--	--	--
Crude steel[e] ____ do	72,000	75,000	75,000	90,000	90,000
Quartz ____ do	982	2,063	665	2	412
Tellurium, refined ____ kilograms	--	--	(7)	(7)	--
KAMPUCHEA[e 2]					
Cement, hydraulic ____ metric tons	50,000	50,000	10,000	--	--
Gold, mine output, metal content ____ troy ounces	1,000	1,000	--	--	--
Salt ____ metric tons	30,000	30,000	12,000	26,500	30,000
LAOS[e 2]					
Salt, rock ____ do	10,000	10,000	15,000	18,000	20,000
Tin, mine output, metal content ____ do	576	600	400	300	350
MONGOLIA[2 8]					
Cement, hydraulic ____ thousand metric tons	163	100	r166	185	190
Coal:					
Anthracite and bituminous[e] ____ do	205	240	250	250	250
Lignite and brown[e] ____ do	r2,717	3,084	3,548	3,864	4,100
Total ____ do	2,922	3,324	3,798	4,114	4,350

See footnotes at end of table.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities[1] —Continued

Area, commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
MONGOLIA[2 8] —Continued					
Copper, mine output, metal content metric tons	--	--	[e]4,000	4,080	4,000
Fluorspar, all grades -- thousand metric tons	[e]302	[e]320	455	567	580
Gypsum ---------- do	[e]25	[e]28	[e]28	28	30
Lime, hydrated, and quicklime ---------- do	[e]40	[e]50	36	46	50
Petroleum refinery products:[e 9]					
Kerosine ---------- thousand 42-gallon barrels	16	23	23	23	NA
Residual fuel oil ---------- do	13	20	20	20	NA
Salt ---------- metric tons	[e]11,000	[e]15,000	[e]15,000	15,000	15,000
NEPAL[10]					
Beryllium: Beryl, industrial-grade (10%-12% BeO) kilograms	[e]1,000	777	320	120	[4]140
Cement, hydraulic ---------- metric tons	29,565	42,036	35,850	21,364	[4]30,744
Clay for cement manufacture ---------- do	NA	NA	3,000	4,000	[4]4,000
Coal: Lignite ---------- do	1,824	1,956	1,700	37,530	[4]3,461
Copper ore:					
Gross weight ---------- do	5	6	[e]35	--	[4]6
Cu content ---------- do	[e]1	[e]1	7	--	[4]1
Gem stones:					
Beryl ---------- kilograms	NA	5	2	--	[4]140
Garnet ---------- do	25,000	29,600	12,000	4,000	[4 11]41,295
Tourmaline ---------- do	50	75	50	25	NA
Lime, agricultural ---------- metric tons	NA	NA	NA	10,054	[4]10,000
Magnesite, crude ---------- do	--	--	--	--	[4]15,000
Salt ---------- do	6	NA	7	7	[4]8
Stone:					
Limestone ---------- do	[e]50,000	54,391	50,000	62,400	[4]32,400
Marble:					
Chips ---------- do	NA	67	131	66	[4]343
Cut ---------- square meters	1,670	761	1,370	863	[4]3,083
Craggy ---------- do	3,910	NA	2,320	799	NA
Talc ---------- metric tons	52	77	510	325	[4]1,460
SINGAPORE[2]					
Cement, hydraulic[e] --- thousand metric tons	1,350	1,350	1,350	1,350	1,350
Iron and steel metal: Crude steel ---------- do	203	206	280	297	300
Petroleum refinery products:					
Gasoline ---------- thousand 42-gallon barrels	11,985	13,152	10,679	17,664	[4]19,144
Jet fuel ---------- do	24,022	21,194	35,970	31,221	[4]32,914
Kerosine ---------- do	10,244	21,173	18,094	20,322	[4]20,610
Distillate fuel oil ---------- do	43,479	51,189	59,775	62,304	[4]63,321
Residual fuel oil ---------- do	52,341	69,436	78,424	85,705	[4]81,309
Lubricants ---------- do	3,001	3,278	3,964	4,316	[4]4,269
Other ---------- do	21,896	28,110	33,131	35,538	[4]30,453
Refinery fuel and losses ---------- do	5,635	9,086	9,953	6,741	[4]10,404
Total ---------- do	172,603	216,618	249,990	263,811	[4]262,424
Stone: Granite, broken -thousand cubic meters	2,524	2,572	2,235	[e]2,500	2,500
Sulfur, byproduct of petroleum --- metric tons	[e]7,000	23,043	25,000	26,000	25,000
SRI LANKA					
Cement, hydraulic ---- thousand metric tons	426	356	575	592	[4]571
Clays:					
Ball clay ---------- metric tons	796	1,590	2,309	13,291	[4]11,457
Kaolin ---------- do	4,360	5,182	5,541	5,870	[4]6,614
Brick and tile clay ---------- do	51,014	132,621	86,000	[e]90,000	[4]62,518
Clay for cement manufacture ---------- do	57,307	34,617	103,232	90,988	[4]21,148
Feldspar, crude and ground ---------- do	3,199	3,679	3,160	3,790	[4]3,955
Gem stones, precious and semiprecious, except diamond ---------- value, thousands	$33,946	$28,828	$33,718	$31,919	[4]$42,819
Graphite, all grades ---------- metric tons	8,290	8,875	10,506	9,402	[4]7,794
Iron and steel semimanufactures ---------- do	28,295	[e]28,000	[e]30,000	[e]30,000	NA
Mica, scrap ---------- do	137	[e]100	140	369	[4]145
Petroleum refinery products:					
Gasoline ---------- thousand 42-gallon barrels	846	858	1,098	782	910
Jet fuel ---------- do	615	580	276	248	270
Kerosine ---------- do	1,460	1,423	1,632	1,449	1,600
Distillate fuel oil ---------- do	2,719	2,722	2,681	2,410	3,550
Residual fuel oil ---------- do	3,421	3,608	3,646	3,563	4,800
Other ---------- do	1,095	1,071	1,069	[e]1,100	1,450
Refinery fuel and losses ---------- do	664	651	390	[r e]387	520
Total ---------- do	10,820	10,913	10,792	9,939	13,100

See footnotes at end of table.

Table 1.—Other Areas of the Far East and South Asia: Production of mineral commodities[1] —Continued

Area, commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
SRI LANKA —Continued					
Phosphate rock metric tons	--	--	--	9,063	--
Rare-earth metals: Monazite concentrate, gross weight do	1	[e]5	200	[r e]250	[4]63
Salt do	140,504	51,923	149,825	121,443	[4]114,279
Sand, glass do	1,240	NA	[e]1,500	2,370	--
Stone:					
Limestone thousand metric tons	647	566	975	1,132	[4]1,261
Quartz, massive metric tons	838	768	803	676	[4]741
Titanium concentrates, gross weight:					
Ilmenite do	55,814	34,092	33,041	55,370	[4]33,956
Rutile do	1,039	978	11,497	14,675	[4]12,789
Zirconium: Zircon concentrate, gross weight do	10	[e]10	3,297	1,510	[4]3,031
VIETNAM[12]					
Cement, hydraulic thousand metric tons	738	845	843	729	850
Chromium: Chromite metric tons	13,500	[r e]12,400	13,100	[e]14,000	15,000
Clays: Kaolin[e] do	1,000	1,000	1,100	[r]1,200	1,250
Coal: Anthracite thousand metric tons	5,600	6,200	6,000	5,300	[4]5,800
Gypsum[e] metric tons	10,000	12,000	13,600	14,000	15,000
Iron and steel metal:					
Ingot steel thousand metric tons	75	88	98	[e]110	120
Semimanufactures, rolled[e] do	20	40	50	[r]55	60
Nitrogen: N content of ammonia[e] metric tons	--	10,000	20,000	25,000	NA
Phosphate rock[e] do	1,500	1,500	1,800	400	500
Salt thousand metric tons	581	580	530	[e]525	520
Tin:					
Mine output metric tons	[e]250	[e]250	[e]250	[e]200	[4]370
Metal, smelter do	[e]200	[e]200	[e]200	[e]160	350
Zinc:					
Mine output, metal content[e] do	10,000	10,000	8,000	6,000	6,500
Metal, smelter, primary[e] do	9,000	9,000	7,200	5,400	5,500

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Aug. 18, 1981.

[2]In addition to the commodities listed, other crude construction materials such as sand and gravel and other varieties of stone presumably are produced, but available general information is inadequate to make reliable estimates of output levels.

[3]Data are for years ending June 30 of that stated.

[4]Reported figure.

[5]May include other clays.

[6]Gross production is not reported; the quantity vented, flared, or reinjected is believed to be negligible.

[7]Revised to zero.

[8]In addition to the commodities listed in the body and footnote 2, molybdenum production was initiated in October 1978, but output is not reported and no basis is available for reliable estimates of output levels.

[9]As reported by Statistical Office of the United Nations in 1979 Yearbook of World Energy Statistics, p. 557.

[10]Data are for the Nepalese fiscal year ending mid-July of that stated.

[11]Figure includes both gem- and industrial-grade garnet; 4,295 kilograms gem quality and 37,000 kilograms industrial quality.

[12]In addition to the commodities listed, iron ore was mined in the past and pig iron was produced at industrial facilities, but the status of these industries under prevailing conditions is not sufficiently clear to allow formulation of reliable estimates of output levels. Similarly, data on output of crude construction materials are not available and no basis is available to make reliable estimates of output levels.

BRUNEI[7]

Oil and natural gas production accounted for 88% of the gross national product (GNP) for Brunei during 1980 and approximately 98.4% of total export earnings.

This tiny (5,765 square kilometers) sultanate situated on the northwest coast of Kalimantan Island (formerly Borneo) and inhabited by only about 215,000 people, was a major South Asian producer of both oil and natural gas. As a result of this production, the people of Brunei enjoy the highest per capita income in Asia and one of the highest in the world.

1980 was the first year in a new 5-year development plan for Brunei. The main objectives of the new plan include improvements in the economic, social, and cultural life of the people. They aim toward a high level of employment, diversification through the development of natural resources such as agriculture, forestry, and fisheries, and the achievement of a minimum annual growth rate of 6%.[8]

Although a British protectorate since

1888, in 1978 agreement was reached with Britain that Brunei would assume full international responsibility for defense and foreign affairs as an independent nation at the end of 1983. After independence is complete, Brunei will have the choice of joining the British Commonwealth or accepting the expected invitation to become the sixth member of the Association of Southeast Asian Nations (ASEAN).

Brunei is now run almost entirely by Chinese businessmen, accountants and shopkeepers who maintain everyday services. Apart from a small minority, the 54,000 Chinese have British-protected passports. After the British leave, the Chinese could become stateless—a consideration that worried both the Chinese and British officials who have been helping the Brunei Government get ready for a smooth transition. One of Britain's conditions for independence was proper treatment for the Chinese.

Rather than wait until 1983 to find out what would happen, many Chinese, including important contractors in the offshore oilfields, have made plans to move their money out of Brunei—in most cases to Singapore—and were getting ready to move themselves and their families. The Chinese would take with them much of Brunei's business infrastructure, leaving doubts about how the relatively unskilled Brunei native population would cope.[9]

COMMODITY REVIEW

Brunei's crude oil production during the first half of 1980 was reported by Brunei Shell Petroleum Co. (BSP) to be in the neighborhood of 240,000 barrels per day, slightly lower than the 1979 level of 268,000 barrels per day. This reduction apparently reflected a deliberate effort to maximize ultimate hydrocarbon recovery from the estimated reserves of 1.8 billion barrels of crude oil and 7.7 trillion cubic feet of gas in BSP fields.

There were more than 550 wells in the BSP system of 5 major fields including Southwest Ampa, Seria, Fairley, Fairly-Baram, and Champion.

Champion, the newest of the fields, was being expanded during 1980 from three offshore platforms to a total of nine, to be functional by the end of 1981. A new gas compression station was being added as a part of the project and was expected to provide an additional 150-million-cubic-foot-per-day lifting capacity when completed.

In mid-1980, BSP ordered additional offshore production platforms from Hyundai Shipbuilding of the Republic of Korea, to be delivered at yearend 1981. The purchase of up to 80 such structures over the next 15 years was reportedly planned.

BSP's decades-old oil marketing monopoly was interrupted by the appearance of Saberu Co., owned by high Government officials. The company made a profitable 50,000-barrel-per-day sale during the year to a Japanese trading company in an apparent attempt to loosen Shell's hold over the marketing of Brunei's major natural resource.[10]

Natural gas production was estimated by BSP at 1,060 million cubic feet per day during most of 1980. Two 71-centimeter (28-inch) pipelines carry gas from the Southwest Ampa Field to the Brunei LNG facility at Lumut. The reported production appeared beyond the market capacity of the LNG plant, which utilizes five production trains at 150 million cubic feet per day each. The loading facilities and tanker transport fleet are balanced to operate most efficiently at the design rate. It was possible that the reported excess gas production was reinjected into the oilfields to maintain field pressure.

Only one of the 1979 exploratory finds, Rasau-6x, was still being considered by BSP for development. During 1980, one exploratory well, Parak-ISTR, was sunk off the shore of Brunei. It reportedly flowed at 12,900 barrels per day.[11]

CHRISTMAS ISLAND[12]

Phosphate rock and dust remained the only commercially produced mineral commodity on Christmas Island during 1980. The island, located in the Indian Ocean 2,600 kilometers northwest of Perth, Australia, was made up of volcanic bedrock covered by coral limestone that forms an irregular pattern of pinnacles. The coral limestone was covered by phosphate rock in beds averaging 6 meters in depth. There were three basic grades of phosphate, ranging from 25% to 36.5% P_2O_5. The main export grades averaged 35.24% P_2O_5 for the top quality and 33.0% P_2O_5 for the second

grade. A small amount of 30.0% P_2O_5 average grade material was also exported. The total value of phosphate exports for 1980 was $67 million.[13]

Production took a significant jump in 1980. The island's aggregate production was nearly 30 million tons of ore in 81 years of mining.

The major importers using the Christmas Island product were Australia and New Zealand. Malaysia increased its purchase of high iron and aluminum material suitable for direct application to particular crops.

Table 2.—Christmas Island: Exports of phosphate rock, by destination

(Thousand metric tons)

Destination	1977	1978	1979
Australia	541	610	632
Indonesia	13	15	--
Malaysia	--	135	111
New Zealand	575	624	612
Singapore	133	4	5
Total	1,262	1,388	1,360

HONG KONG[14]

Mineral production in 1980 in Hong Kong was limited to quartzite and small amounts of feldspar and kaolin. All mining was by opencast methods. Most of the feldspar was exported to Taiwan, while the quartz and kaolin were consumed by local industries. Total production of both fine and coarse quartzite aggregates was close to 13.5 million tons. During the year, there were two Government-operated quarries, eight contract quarries, and one rock-crushing facility in operation. One of the contract quarries, established in 1978, completed the installation of its main crushing plant in early 1980. During the year, a little over 1 million cubic meters of fine marine dredge sand was imported for use by the building industry, and a smaller quantity of river sand was also imported from China.[15]

Hong Kong's production capacity for cement was around 1.5 million tons per year at the end of 1980 compared with an annual demand of 2.4 million tons. Current production is from imported clinker. In January 1980, the Government approved the construction of a 1.4-million-ton-per-year cement plant at Sui Lang Shui, near Tuen Mun. The $265 million plant, to be opened in 1982, will be owned by the China Cement Co. Kaiser Cement Corp. of California holds 40% equity in China Cement, and the remainder is held by Cheung Kong Holdings, which also has a 30% share holding in Green Island Cement of Hong Kong.[16]

With the development of China's international trade, Hong Kong continued to reap the benefits of a long established entrepot-entity, most importantly in the role of an Asian financial center and gateway to China.[17] Hong Kong's total trade in 1980 was valued at $42.8 billion. Domestic exports totaled $13.9 billion; reexports, $6.1 billion; and imports, $22.8 billion. The major sources for Hong Kong's imports in 1980 were Japan, $5.2 billion; China, $4.5 billion; and the United States, $2.7 billion. The major export destinations during the year were the United States, $4.6 billion; the Federal Republic of Germany, $1.5 billion; and the United Kingdom, $1.4 billion. Major destinations for reexports were China, $1.7 billion; Japan, $1.2 billion; the United States, $0.6 billion; and Taiwan, $0.4 billion. In 1980, imports of raw materials and semimanufactures alone totaled $9.5 billion (imports of fuels was $1.5 billion). The principal commodities exported included apparel and clothing accessories; watches and clocks; toys and dolls; textile fabrics; radios; metal manufactures (mostly cutlery and household utensils); travel goods, handbags, and similar items; and electronic components.[18]

Table 3.—Hong Kong: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	4,500	8,760	--	Taiwan 6,500; Japan 2,000.
Oxide and hydroxide	3,620	1,396	--	Mainly to Indonesia.
Metal including alloys, all forms	r20,551	23,929	2,043	Japan 8,195; Taiwan 2,805; North Korea 2,338; Singapore 1,161.
Arsenic trioxide, pentoxide, acids	8	7	--	Thailand 5; Indonesia 2.
Beryllium metal including alloys, unwrought	3	--	--	
Chromium oxide and hydroxide	63	61	--	Indonesia 46; Singapore 7; Taiwan 5.
Cobalt oxide and hydroxide	21	7	--	Singapore 3; Taiwan 3.
Copper:				
Sulfate	24	32	--	Indonesia 29; Singapore 2; Taiwan 1.
Oxide and hydroxide	3	3	--	All to Malaysia.
Metal including alloys, all forms	r12,694	15,447	480	Japan 11,636; India 1,393.
Gold metal including alloys, unworked or partly worked, troy ounces	83,946	299,612	3,151	Taiwan 223,833; Japan 66,809.
Iron and steel metal:				
Scrap, thousand tons	286	374	(1)	Taiwan 236; Thailand 64; Japan 37.
Pig iron, steel ingot, similar material	100	1,418	--	China, mainland 1,134; Republic of Korea 38.
Steel, primary forms	6,352	9,692	--	Singapore 6,541; Philippines 2,781.
Semimanufactures	50,614	91,965	113	Indonesia 20,968; China, mainland 15,043; Macau 14,078.
Lead:				
Oxide	23	33	--	Indonesia 30; Singapore 3.
Metal including alloys, all forms	1,445	1,838	3	Taiwan 1,034; China, mainland 72; Republic of Korea 43.
Magnesium metal including alloys, all forms	28	140	--	North Korea 117; Japan 14.
Manganese oxide	60	74	--	Indonesia 50; China, mainland 18.
Nickel:				
Oxide and hydroxide	37	38	--	Taiwan 24; Belgium 13.
Metal including alloys, all forms	1,292	1,830	--	North Korea 508; Japan 425; Republic of Korea 371.
Platinum-group metals:				
Waste and sweepings, value	$55,270	$584,663	--	United Kingdom $427,352; Japan $97,219; Switzerland $60,092.
Metal including alloys, unworked or partly worked, troy ounces	22,152	19,483	--	Taiwan 15,754; Japan 2,090; Australia 1,254.
Silver:				
Waste and sweepings, value, thousands	--	$13,210	$32	Switzerland $8,471; West Germany $3,308; United Kingdom $1,304.
Metal including alloys, unworked and partly worked, thousand troy ounces	429	1,455	7	United Kingdom 915; Switzerland 448.
Tin metal including alloys, all forms	1,013	1,818	--	Taiwan 434; China, mainland 362; North Korea 295.
Titanium oxide	3,036	1,878	--	Indonesia 1,413; Taiwan 183; Malaysia 61.
Tungsten metal including alloys, all forms	3	3	--	Mainly to United Kingdom.
Zinc:				
Oxide	41	89	--	Singapore 40; Nigeria 23; China, mainland 10.
Metal including alloys, all forms	3,963	2,979	--	Philippines 1,532; Japan 759; Thailand 226; Malaysia 215.
Other metals, n.e.s.:				
Oxides, hydroxides, peroxides of metals	24	239	--	All to Republic of Korea.
Metals:				
Metalloids	7	16	11	Netherlands 3.
Base metals including alloys	446	909	66	Japan 345; Belgium 165; North Korea 110; Philippines 94.
Ash and residue containing nonferrous metals	346	540	(1)	Taiwan 540.
NONMETALS				
Abrasives, natural, n.e.s.:				
Grinding and polishing wheels and stones	471	620	5	Indonesia 315; Nigeria 103; Pakistan 57.
Dust and powder of precious and semiprecious stones, value	$850	$4,099	--	Thailand $2,293; China, mainland $1,268; Vietnam $538.
Unspecified	102	95	--	Japan 72; Indonesia 11; Taiwan 7.
Asbestos	225	1,844	--	Indonesia 1,330; Venezuela 504.
Barite and witherite	72	98	--	Indonesia 91; Malaysia 6.

See footnotes at end of table.

Table 3.—Hong Kong: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Cement	4,084	7,624	--	Macau 4,014; China, mainland 3,005.
Clays and clay products including all refractory brick:				
Crude clay, n.e.s.	48,307	59,968	--	Taiwan 55,343; Indonesia 3,593.
Products value, thousands	$1,833	$2,835	$43	Macau $591; Nigeria $370; Indonesia $237.
Diamond:				
Gem, not set or strung thousand carats	365	371	42	Belgium 138; Israel 62; Japan 51; Singapore 37.
Industrial do	r1	12	--	Mainly to China, mainland.
Diatomaceous earth	38	40	--	India 29; Taiwan 8.
Feldspar and fluorspar	6,385	13,249	--	Indonesia 6,940; Taiwan 3,650; Singapore 2,657.
Fertilizer materials:				
Crude	418	805	10	Taiwan 721; Thailand 63.
Manufactured	142	32,306	1	China, mainland 31,749.
Ammonia	1	20	--	Indonesia 15; Thailand 4.
Graphite	622	817	297	Taiwan 520.
Gypsum and plasters	528	31,433	--	Indonesia 31,342.
Lime	128	47	--	Macau 35; Indonesia 12.
Magnesite	1,213	1,320	--	Taiwan 900; Nigeria 300; Philippines 100.
Mica:				
Unworked	33	104	51	Taiwan 47.
Worked including agglomerated splittings	21	27	4	France 7; Sweden 7; Italy 4.
Pigments, mineral, including processed iron oxide	1,015	956	--	Indonesia 890; Singapore 37.
Precious and semiprecious stones, natural and synthetic, other than diamond value, thousands	$137,322	$174,416	$23,751	Japan $73,689; Singapore $25,289.
Salt and brine	35	52	--	Papua New Guinea 50.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	10,194	750	--	Philippines 342; Thailand 115; China, mainland 114.
Caustic potash	83	5	--	Mainly to Indonesia.
Soda ash	358	74	--	Macau 36; Malaysia 20; China, mainland 5; India 5.
Stone, sand and gravel:				
Dimension stone	4,350	3,043	13	Taiwan 1,716; Indonesia 895; Philippines 208.
Gravel and crushed rock	116	110	--	Indonesia 88; Cameroon 17.
Quartz and quartzite	544	668	--	Thailand 291; Indonesia 150; Singapore 30; Sudan 30.
Sand excluding metal-bearing	2	16	--	Thailand 7; Republic of Korea 5.
Sulfur:				
Elemental, all forms	54	--		
Sulfuric acid	50	21	--	Macau 10; Indonesia 4; Thailand 3.
Talc, steatite, soapstone, pyrophyllite	5,729	8,908	--	Indonesia 7,433; Taiwan 1,012.
Other nonmetals, n.e.s.:				
Crude	102	603	--	All to Taiwan.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	352	653	--	Macau 406; China, mainland 107; Indonesia 107.
Oxides and hydroxides of strontium, magnesium, barium	(1)	10	--	Mainly to Indonesia.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	73	373	--	Macau 319; Republic of Korea 54.
Carbon black and gas carbon	830	298	--	China, mainland 274; Indonesia 20.
Coal and coke including briquets	39	3	--	All to Macau.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	r63	70	--	Do.
Kerosine and jet fuel do	65	151	--	Singapore 49; Indonesia 45; Philippines 37.
Distillate fuel oil do	1,051	430	--	Macau 207; Philippines 199.
Residual fuel oil do	218	431	--	All to Macau.
Lubricants do	223	265	(1)	Tawian 84; Indonesia 82; Saudi Arabia 36.
Mineral jelly and wax do	12	23	--	Singapore 15; Indonesia 3.
Liquefied petroleum gas do	28	33	--	All to Macau.
Other do	r19	12	--	Macau 5; Philippines 2.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	5	6	--	Taiwan 3; Malaysia 1; Philippines 1.

rRevised.
1Less than 1/2 unit.
2Excludes unreported quantity exported in 1978 valued at $1,772.

Table 4.—Hong Kong: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	7,070	9,400	--	All from China, mainland.
Oxide and hydroxide	3,018	1,665	55	China, mainland 1,382; West Germany 151; Japan 71.
Metal including alloys, all forms	40,158	45,633	1,567	Canada 8,628; New Zealand 6,282; Japan 6,113.
Arsenic pentoxide, trioxide, acid	10	18	--	France 12; China, mainland 6.
Chromium oxide and hydroxide	398	447	91	United Kingdom 255; Japan 44.
Cobalt oxide	41	18	--	Belgium 13; United Kingdom 4.
Copper:				
Sulfate	93	229	8	United Kingdom 147; Japan 44.
Oxide and hydroxide	165	181	54	West Germany 87; Norway 22.
Metal including alloys, all forms	32,740	37,734	810	Japan 27,205; China, mainland 3,188; Taiwan 2,751.
Gold:				
Waste and sweepings ---- value	$13,674	$579	--	All from Japan.
Metal including alloys, unworked or partly worked thousand troy ounces	r1,748	3,395	7	United Kingdom 2,046; Switzerland 873.
Iron and steel metal:				
Scrap	r126,132	105,260	1,782	Japan 95,104.
Pig iron, ferroalloys, similar materials	r17,130	22,247	607	China, mainland 8,742; North Korea 7,823; Australia 1,864.
Steel, primary forms	r183,770	257,267	--	Australia 192,455; Taiwan 16,391; West Germany 15,303.
Semimanufactures thousand tons	1,244	1,214	19	Japan 513; Republic of South Africa 204; China, mainland 165; Taiwan 152.
Lead:				
Oxide	275	284	--	China, mainland 105; West Germany 86.
Metal including alloys, all forms	1,593	2,441	148	Taiwan 917; Canada 621; Singapore 274.
Magnesium metal including alloys, all forms	32	88	60	U.S.S.R. 17; Canada 10.
Manganese:				
Ore and concentrate	515	1,000	--	Thailand 840; China, mainland 160.
Oxide	2,246	2,939	--	Singapore 1,132; China, mainland 903; Japan 764.
Mercury ---- 76-pound flasks	1,548	2,153	--	China, mainland 1,930; Spain 200.
Nickel:				
Oxide	174	82	--	France 55; Netherlands 27.
Metal including alloys, all forms	2,488	2,864	47	Canada 1,386; Norway 314; Japan 302; United Kingdom 262.
Platinum-group metals:				
Waste and sweepings ---- value	$1,916	$38,802	--	Japan $27,291; Australia $11,511.
Metal including alloys, all forms thousand troy ounces	124	64	--	West Germany 18; United Kingdom 15; Australia 11.
Rare-earth oxide	9	4	1	France 2.
Silver:				
Waste and sweepings value, thousands	$2	$1,299	--	Japan $625; India $553; Taiwan $111.
Metal including alloys, all forms thousand troy ounces	596	850	17	Philippines 217; Thailand 204; Australia 123.
Tin metal including alloys, all forms	1,551	2,416	37	Malaysia 1,477; Belgium 198; Singapore 178.
Titanium:				
Ore and concentrate[1]	250	141	--	Australia 116; Singapore 25.
Oxide	6,968	6,077	943	Japan 1,823; United Kingdom 1,004; Australia 684.
Tungsten metal including alloys, all forms	4	4	2	Japan 1.
Zinc:				
Oxide	645	688	13	Canada 235; West Germany 116; France 97.
Metal including alloys, all forms	26,532	27,874	70	North Korea 6,878; China, mainland 3,001; Peru 2,717; Canada 2,706.
Other metals, n.e.s.:				
Ash and residue containing nonferrous metals	400	440	--	All from China, mainland.
Oxides, hydroxides, peroxides of metals	117	287	9	China, mainland 261; Japan 14.

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Other metals, n.e.s. —Continued				
Metals:				
Metalloids	1	60	14	West Germany 21; United Kingdom 18; Australia 6.
Base metals including alloys, all forms	[2]661	[2]1,239	22	China, mainland 543; Malaysia 174; Philippines 123; Japan 81.
NONMETALS				
Abrasives, n.e.s.:				
Natural:				
Dust and powder of precious and semiprecious stones —value	$11,289	$16,975	--	Switzerland $8,441; United Kingdom $4,596; China, mainland $2,930.
Grinding and polishing wheels and stones	1,809	2,696	39	Japan 744; Republic of Korea 675; China, mainland 562; Taiwan 294.
Unspecified	848	666	240	Japan 351; Italy 61.
Artificial corundum	6	506	65	India 431; West Germany 9.
Asbestos	2,406	1,844	35	China, mainland 1,734; Japan 20.
Barite and witherite	258	335	--	China, mainland 206; United Kingdom 77; Thailand 50.
Boric acids	201	307	284	China, mainland 20.
Cement, hydraulic —thousand tons	2,352	2,575	[3]	Japan 924; China, mainland 725; Republic of Korea 556.
Clays and clay products (including all refractory brick):				
Crude	26,188	50,613	2,102	China, mainland 28,543; Macau 12,953; France 3,424.
Products —value, thousands	[r]$904,715	$44,646	$146	China, mainland $13,609; Italy $10,901; Japan $5,630.
Cryolite and chiolite	17	11	--	All from Denmark.
Diamond:				
Gem —thousand carats	1,413	1,055	50	India 374; Israel 271; Belgium 167; Republic of South Africa 79.
Industrial —do	[r]70	57	--	Australia 18; Ireland 16; Singapore 12.
Diatomaceous earth	264	242	236	Japan 6.
Feldspar and fluorspar	6,327	13,838	--	China, mainland 12,878; Japan 860; Thailand 100.
Fertilizer materials:				
Crude	1,077	1,269	9	China, mainland 901; Thailand 205; Netherlands 72.
Manufactured:				
Nitrogenous	4,554	56,166	113	Republic of Korea 23,000; Japan 21,118; West Germany 11,291.
Other including mixed	6,988	8,039	92	West Germany 6,815; Taiwan 400; United Kingdom 378.
Ammonia	[r]703	1,032	15	Japan 913; United Kingdom 51; China, mainland 29.
Graphite	1,201	1,325	10	China, mainland 765; Sri Lanka 510; Republic of Korea 30.
Gypsum and plasters	62,120	132,726	286	Japan 72,623; Mexico 5,450.
Lime	32,918	45,611	--	China, mainland 43,074; Taiwan 2,167; Japan 334.
Magnesite	2,413	2,672	317	China, mainland 2,103; Japan 450; United Kingdom 118.
Mica, all forms	337	585	9	Japan 412; India 79; China, mainland 50.
Pigments, mineral:				
Crude	330	288	38	China, mainland 250.
Iron oxide, processed	1,109	1,675	190	China, mainland 746; Japan 508; West Germany 160.
Precious and semiprecious stones, natural and synthetic, other than diamond —value, thousands	[r]$75,601	$82,522	$5,078	Singapore $22,420; Thailand $12,171; Japan $7,647.
Salt	57,985	73,207	5	China, mainland 40,510; Taiwan 14,199; Thailand 6,551.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	27,829	17,066	1,059	China, mainland 7,748; Poland 2,002; West Germany 1,833.
Caustic potash	134	141	2	West Germany 59; Japan 46; Italy 18; Sweden 10.
Soda ash	21,733	25,932	1	East Germany 9,382; Kenya 5,265; Romania 4,382.
Stone, sand and gravel:				
Dimension stone	4,525	1,328	--	China, mainland 1,139; Italy 91; Taiwan 43.

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite	--	10	--	All from Taiwan.
Gravel and crushed rock	276,685	186,889	--	Macau 179,473; China, mainland 7,203.
Limestone, except dimension	24,607	35,813	100	China, mainland 25,194; Japan 10,369.
Quartz and quartzite	4,021	2,130	--	China, mainland 2,031; Netherlands 23.
Sand excluding metal-bearing thousand tons	r991	1,239	--	Mainly from China, mainland.
Sulfur:				
Elemental, all forms	1,624	1,123	53	Japan 844; West Germany 167.
Sulfuric acid	11,189	3,006	48	Taiwan 2,714; United Kingdom 106; China, mainland 85.
Talc and related material	7,684	10,793	328	China, mainland 10,215; Norway 93; United Kingdom 90.
Other nonmetals, n.e.s.:				
Crude	6,064	9,960	76	China, mainland 9,690; Republic of South Africa 150; Philippines 20.
Mineral waste	1,605	929	--	China, mainland 705; Thailand 175.
Oxides, hydroxides, and peroxides of magnesium, barium, strontium	5	5	1	Japan 4.
Bromine, fluorine, iodine	1	(3)	(3)	
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	20,363	19,683	1,984	United Kingdom 7,690; Taiwan 3,340.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,129	2,215	79	Republic of Korea 1,569; United Kingdom 417.
Carbon black and gas carbon	1,244	1,360	265	Australia 450; Japan 281; France 229.
Coal, all grades including briquets	7,711	5,814	2	Vietnam 2,957; China, mainland 2,855.
Coke and semicoke	5,897	6,749	--	Japan 5,939; Taiwan 648; United Kingdom 162.
Petroleum refinery products:				
Gasoline including natural thousand 42-gallon barrels	1,527	1,605	--	Singapore 1,308; China, mainland 297.
Kerosine, jet fuel, white spirit do.	6,425	6,878	(3)	Singapore 4,291; China, mainland 2,403.
Diesel and distillate fuel oils do.	9,688	9,419	--	China, mainland 6,073; Singapore 3,346.
Residual fuel oil do.	26,067	26,393	--	Singapore 19,864; China, mainland 2,225.
Lubricants do.	16	23	2	China, mainland 12; Singapore 3; United Kingdom 3.
Other:				
Bitumen and other mixtures do.	144	136	3	Singapore 96; China, mainland 16.
Liquefied petroleum gas do.	1,146	1,252	--	Singapore 970; Taiwan 127.
Mineral jelly and wax do.	109	126	3	China, mainland 113.
Unspecified do.	1	2	--	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	186	878	30	China, mainland 621; United Kingdom 88; Japan 59; Belgium 57.

r Revised. NA Not available.

[1] Includes ores of vanadium, niobium, etc.

[2] Excludes unreported quantities imported in 1978 valued at $29,983 and in 1979 valued at $311,850.

[3] Less than 1/2 unit.

KAMPUCHEA[19]

The overall output value of the mineral sector has never been significant in Kampuchea (formerly Cambodia) and this condition continued throughout 1980. The country was not an important world producer of any mineral commodity, and given the present state of the economy, this will not change in the near future. The only minerals that have been produced on a locally significant level were phosphate rock, gem minerals, salt, and nonmetallic construction materials for cement, brick, and tile manufacture.

A variety of minerals might be developed given ideal conditions and an intensive exploration effort using modern equipment and techniques.

The armed conflict continued throughout 1980 in Kampuchea but at a reduced level compared with that of 1979. It was reported that approximately 200,000 Vietnamese military personnel remained in the country at yearend 1980. Remnants of Pol Pot's troops continued hit-and-run raids over much of the rural countryside.

As a result of the continued unstable political and military situation, the economy of the country remained in a state of upheaval and no meaningful statistics were available for the year.

In October 1979, the Government authorized the reissuing of money. In March 1980, new banknotes in amounts from 50 riel down to 0.10 riel were issued and a single coin of 0.05 riel value was also issued. During the previous months, transactions had been by barter, with a measure of rice being the usual scale by which value was determined.

Except for donations of food and medical supplies from various international aid groups and foreign countries, virtually no trade was carried on during 1979. It was not until September 1980 that the private Japan-Kampuchea Trade Association announced that it had agreed with Kampuchea's Heng Samrin Government to reopen bilateral trade. The first transaction was to be the export of $200,000 worth of kapok.

COMMODITY REVIEW

A small deposit of phosphate rock has been worked at Tuk Meas in Kampot Province since 1919. Production was not believed to have exceeded 12,000 tons in any one year. Remaining reserves were estimated at 320,000 tons. The Monkol Borei phosphate fertilizer plant in Battambang Province opened in 1977. Reserves near the plant were estimated at between 360,000 and 400,000 tons of 20% P_2O_5 ore. The ore was ground to under 0.1 millimeter grain size and applied directly to the cropland with no chemical processing or blending attempted. Current production level at these plants was not known but every effort was made to keep them operating because of their importance to the agricultural sector.

Kampuchea produced salt for domestic use from at least two areas, mostly by evaporation of seawater. The salt pans in Kampot Province covered 4,000 hectares and employed 400 workers. Production was believed to have more than doubled in 1979 and probably increased a small amount in 1980.

A small glassware factory was operating at Boeng Cheung Ek, using local sand and other raw materials.

Small, batch-fired, charcoal-fueled foundries operated at several locations. The furnaces were charged with steel scrap and locally mined iron ore. Output from the foundries was used to make agricultural tools, kitchen utensils, metal fasteners, and replacement parts for a variety of equipment.

The largest known iron ore deposit in Kampuchea was at Phnom Deck (13°14'N, 105°03'E) in Preah Vihear Province, where small amounts of magnetite and hematite have been mined since ancient times. French and Japanese firms explored the deposits before 1945, but large-scale exploitation was not feasible because the 6-million-ton reserve was insufficient to justify the expense of building infrastructure into this remote area.

Both primary and placer gold deposits are known. The Bo Sup Trup deposit in the northwestern Province of Otdar Meanchey has been exploited since 1877. The gold-bearing quartz veins also contain trace amounts of pyrite, sphalerite, galena, chalcopyrite, malachite, and silver. The reserve was estimated at 440,000 tons of 15-gram-per-ton gold ore. Current production level, if any, was not known.

Bricks and roofing tile were made from local deposits of clay in several areas. Kilns were reported in Phnom Penh, Phum Prek

Rieng, and in Tram Kak, Angkor Chey, and Chamkar Lev Districts. The production status of these plants was not known in 1980. Presumably, at least some of them were operating to furnish needed building materials for reconstruction.

Tin occurs near Knangay as fine-grained primary mineralization in aplite. The cassiterite grains were smaller than 0.12 millimeters and made extraction difficult. The nearby eluvial and alluvial deposits were not large enough for profitable mining. Tin is mined commercially across the border in Thailand and further exploration could reveal more exploitable occurrences.

Sulfide mineralization containing lead, zinc, and iron has been reported at Samrong (11°50'N, 103°55'E); lead, zinc, and copper at Banchai in the Seasan Valley; and copper and lead at Rorieng (Phnamker). The Samrong deposits were exploited by Chinese miners in the 1850's but were subsequently abandoned. In 1961, the Samrong area was recommended for a modern geochemical soil survey by a French exploration team. However, political conditions have prevented any further work in the area.

The mineral fuel situation in Kampuchea was not encouraging. No oil or natural gas was produced, and there was no known exploration conducted either onshore or offshore during 1980. Some coal occurrences were reported in Kracheh, Battambang, and Kampong Thum Provinces, but none were of a grade or thickness that would warrant exploitation.

The small French-built petroleum refinery at Kampong Som, damaged 8 years ago in a military conflict, was not repaired in 1980. The country's very small petroleum needs were satisfied by imports of petroleum products.

LAOS[20]

During 1980, the Lao People's Democratic Republic completed a 3-year interim plan for economic recovery with limited success. These years were traumatic and frustrating for both the Laotian people and the new Government as they sought to transform the country along Socialist lines. The result has been a steady exodus of refugees, continuing economic problems, and sporadic armed resistance in the southern provinces. Some advances have been made in reconstruction, increasing agricultural output, transportation improvements, and other public services and social conditions.[21]

In November 1980, the Laos Council of Ministers outlined the aims of the first 5-year plan (1981-85). Some of the minimum goals included increasing gross social product by 65%, gross national income by 38%, agricultural production by 23%, transport capability by 80%, and gross industrial production by 200%. As part of the industrial goal, the Ministry of Industry and Trade was instructed to "...use more effectively all available...natural resources so as to create primary factors for transforming the country into an industrialized state." No specific goals were mentioned in the mineral sector.

Official data on the economy of the country as a whole were not available, and little was known of the present status of the mineral sector.

Laos was one of the poorest countries in the world with a GNP probably less than $325 million and a per capita income on the order of $95 per year. Inflation was reportedly under control at the end of 1979 and for the first 3 months of 1980, but climbed sharply in the later months of 1980. One of the reasons for the inflation was a 2-month closing of the Thailand border after an armed clash on the Mekong River in June. Only one border crossing point reopened, causing continuing problems to border trading activities. This constriction of trade, especially in basic consumer goods, has contributed to continuing price increases.

In order to moderate the effects of the border bottlenecks, the Government was putting a priority on rebuilding Route 13 between Vientiane and Savannakhet, and Route 9 between Savannakhet and the Vietnamese border crossing, where it connects with a road network leading to the port of Da Nang. Sweden, the Soviet Union, and at least one other East European country have agreed to help in the work. Currently, the route is a limited fair-weather road of very low capacity. Trade through Vietnam will bypass the politically sensitive Thai-Laos border areas.

One major hindrance to revitalizing the economy and trade was the critical lack of skilled personnel. It was estimated that up to 300,000 people, or 10% of the population, have left the country since 1975. In many cases the refugees were the commercial and educated elite of Laos, causing a severe shortage of trained personnel most needed to help in the rebuilding process. Attempts

at forcibly preventing people from leaving had been counterproductive, and the Government now uses political education and persuasion to restrict the exodus. The official policy regarding those who do leave, however, is that they are welcome to return at any time.[22]

Some progress was being made toward delineating the mineral resources of the country. Exploration agreements have been signed with Vietnam and Czechoslovakia. Vietnam was to help in preparing geological maps of the Xieng Kmoung and Samneua regions, survey the iron deposits in Ieng Khouang, and explore for construction material resources in Kieng Khouang, Khammoune, and Savannakhet Provinces. In July 1980, Czechoslovak and Laotian officials signed a "mine exploration cooperation agreement."[23] The terms of the agreement were not available.

Laos has potentially rich occurrences of a number of valuable minerals. There are known deposits of coal, gypsum, iron ore, potash, salt, and tin. However, Laos' mineral resources continued to be virtually unused during 1980. As in past years, except for tin, Laos produced no minerals of significance to the world market. The overall mineral output was too small to be an important factor in this highly agricultural country. The French-owned Phontiou tin mine used to produce several hundred tons of concentrate annually before it was nationalized in 1977. Production declined for the next 2 years but was believed to have recovered during 1980. Tin was probably the only mineral currently minable for the export market without the necessity of an unmanageably large capital outlay.

The Nam Ngum hydroelectric power project continued to be one of the two largest foreign exchange earners for Laos. Over 80% of the total power generated from the 110,000-kilowatt plant was sold across the border to the northeast section of Thailand. Despite the political differences between the countries and the midyear border closing, power was not interrupted during the year.

A fifth generator was reportedly being installed and will bring total capacity to 140,000 kilowatts. The Laos and Japanese Governments signed an agreement in August 1980 for the repair of the two 15,000-kilowatt first-stage generators at the plant. The work was scheduled for completion in 1980.

In a continuing effort to utilize the inexpensive power available from the Nam Ngum plant, the electric power grid in Laos was being extended into some of the more remote communities. The limited availability of power, coupled with poor transportation facilities, has been a hindrance to the development of mineral resources in most provinces.

COMMODITY REVIEW

The export of tin concentrate was the major foreign exchange earner for Laos for a number of years. In 1977, the French-owned tin mine at Phontiou was nationalized without compensation and production stopped for a short period, then resumed at a reduced output. The 5-year plan called for increased production from Phontiou and a smaller mine in Boneng District. Government officials have mentioned that exploration for new tin deposits was continuing and indicated that other small mines may have contributed additional production in 1980. It appeared that the Government intended, with Soviet technical assistance, to surpass the old 500- to 1,000-ton-per-year production level in the next few years.

Salt was produced in at least two provinces during 1980. The main production came from mines or brine wells at Ban Keun, Ban Bo, and Kok Sa-at (Ban Khoksawat) in Thoulakhom District of Vientiane Province. The output easily met the local needs and provided a substantial surplus for distribution to other provinces. A new salt pit was opened in late 1979 at Ban Boten in Laung Namtha Province. Production during 1980 was sufficient to supply the entire demand of the province. Total national salt production was not available but was believed to be sufficient to supply the minimum needs of the country.

A rich deposit on potash minerals straddling the border east of Vientiane was discovered in the 1970's. The main sylvite bed, which continued southward well into Thailand, averages 3.5 meters thick and occurs at depths between 94 and 432 meters. There was no known progress toward developing the deposit during 1980. Development of this much needed fertilizer raw material is dependent on the availability of large amounts of capital. This Lao-Thai deposit is the only known high grade occurrence of potash minerals in Southeast Asia.

Large reserves of iron ore have been reported in the Phu Nhouan Mountain Ridge north of Xiengkhoang. Several hundred million tons of very high-grade magne-

tite has been indentified. Exploitable deposits have also been discovered at Phu San and in the Pha Lek and Sam Neua Districts.[24] Vietnam was helping with exploration of these deposits, none of which were being exploited. Large-scale development of any of these deposits would require a capital outlay beyond the means of the Laotian economy at this time.

There were known occurrences of precious gem stones in Laos. In particular, a sapphire deposit was being mined at Houai Sai in Loung Namtha Province. Czechoslovak technicians were reportedly helping in the mining.

Common mineral construction materials were produced in Laos for domestic consumption. Most quarries or plants were small and produced for canton or district use only. The largest brick plant was located in the outskirts of Vientiane and probably produced about 4,000 tons of finished brick in 1980. Limestone was mined and calcined into agricultural lime in small, single batch kilns. Gypsum was produced in small quantities in several places before 1980. In 1980, a new operation called the Dong Hen Quarry began production in Savannakhet Province. Production was reported to be 13,000 tons in the first part of 1980. Plans were to reach full capacity in 1981. The new quarry probably was the result of a 1978 agreement with Vietnam to cooperate in the development of the Savannakhet gypsum deposit. Vietnam had three large cement plants under construction and will import most of the Dong Hen gypsum. A modern 200,000-ton-per-year cement plant will be built in Vang Viang District (18°56'N, 102°27'E), Vientiane Province, with Soviet technical assistance and financing. Design and construction of the infrastructure for the plant began in 1980.

Laos produced no crude oil or natural gas, and there was no known drilling conducted during 1980 or the previous 2 years. Laos imported small amounts of petroleum products from Thailand and an unknown quantity from Vietnam through a small pipeline.

Coal occurs in Vientiane and Saravane Provinces but is only mined and consumed locally. Production could total a few thousand tons per year.

MONGOLIA[25]

Under an economic and technical cooperation agreement between Mongolia and the U.S.S.R., the Soviet Union was to assist Mongolia in its transition from an agricultural-based economy to an industrial base by the end of 1985. By mid-1979, first-stage construction of the copper-molybdenum mining and concentrating combine at Erdenet was reportedly completed. Commission of the work on the second-stage construction was to be in 1980. When completed, ore output at Erdenet was to increase from 4 million tons per year to 16 million tons per year in 1982. Through joint efforts, expansion of the fluorspar mines at Berhe, Dzun-tsag an Dlle, and Bor-Under could be completed by 1985 as well as the construction of a fluorspar concentrating combine.

Commissioning of the first stage of a coal mine at Baga-Nur was to coincide with the completion of the reconstruction of the coal enterprises at Sharyngol and Adunchulun. The coal-based thermal power station No. 4 in Ulaanbaatar was to be put into operation and the power-generating facilities at Darhan and Choybalsan were to be reequipped.[26]

On August 4, 1980, a contract between the Kompleksimport Association of Mongolia and the All-Union Teknostroyeksport Association of the U.S.S.R. was ratified for the construction of the Hotol cement and lime complex. The project includes a 100,000-ton-per-year limestone quarry, a 65,000-ton-per-year lime plant, and a 500,000-ton-per-year cement plant.[27]

Table 5.— Mongolia: Apparent exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commmodity	1978	1979	Principal destinations, 1979
METALS			
Aluminum metal including alloys, unwrought	--	81	All to Italy.
Iron and steel metal:			
Scrap	19,110	20,000	All to U.S.S.R.
Pig Iron	--	200	All to Greece.
Ferroalloys	--	20	All to Yugoslavia.
Semimanufactures:			
Bars, rods, angles, shapes, sections	r10	397	All to Saudi Arabia.
Universals, plates, sheets	r14	104	Do.
Wire	--	49	Do.
Tubes, pipes, fittings	r16	188	Do.
Castings and forgings, rough	--	211	Do.
NONMETALS			
Cement[2]	40,200	27,800	Mainly to U.S.S.R.
Clay products, nonrefractory	--	3	All to Saudi Arabia.
Stone, dimension, worked	--	33	Do.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, crude thousand 42-gallon barrels	--	105	All to Italy.

rRevised.

[1]Owing to a lack of official trade data published by Mongolia, this table should not be taken as a complete presentation of Mongolia's mineral export. These data have been compiled from various sources which include United Nations information and data published by the partner trade countries. Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[2]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

Table 6.—Mongolia: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum metal including alloys, semimanufactures	1	--	
Iron and steel metal:[2]			
Pig iron	1,400	2,400	NA.
Rolled semimanufactures	30,200	39,600	NA.
Tubes and pipes	5,800	10,400	NA.
NONMETALS			
Abrasives, grinding and polishing wheels and stones	--	1	All from Japan.
Cement[2]	67,300	47,300	U.S.S.R. 44,000.
Clay products:			
Refractory	2,315	2,693	All from U.S.S.R.
Nonrefractory	NA	1,164	All from Italy.
Fertilizer materials, manufactured:			
Nitrogenous, N_2 content[2]	25,800	24,000	U.S.S.R. 4,515.
Phosphatic, P_2O_5 content[2]	18,900	20,200	Mainly from U.S.S.R.
Salt	4,262	1,458	All from U.S.S.R.
Sodium and potassium compounds, n.e.s.:[2]			
Caustic soda	100	500	NA.
Soda ash	r1,000	NA	NA.
Stone, dimension:			
Crude and partly worked	--	18	All from Italy.
Worked	--	15	Do.
Sulfur:			
Elemental, other than colloidal	NA	1	All from West Germany.
Sulfuric acid[2]	1,200	1,300	All from U.S.S.R.

See footnotes at end of table.

Table 6.—Mongolia: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
MINERAL FUELS AND RELATED MATERIALS			
Coal: Anthracite and bituminous[2]	100	15,000	NA.
Petroleum and refinery products:[2]			
Crude thousand 42-gallon barrels	42	44	NA.
Refinery products:			
Lubricants do	r134	152	NA.
Other do	r3,767	4,066	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,008	1,080	All from U.S.S.R.

rRevised. NA Not available.

[1]Owing to a lack of official trade data published by Mongolia, this table should not be taked as a complete presentation of Mongolia's mineral imports. These data have been compiled from various sources, which include United Nations information and data published by the individual partner trade countries. Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[2]Statistical Yearbook of Members of the Council for Mutual Economic Assistance, Moscow, U.S.S.R.

NEPAL[28]

Nepal is a small landlocked country between the Chinese province of Tibet and the Indian States of Uttar Pradesh and Bihar. It mainly occupies the south slope of the Himalayan Mountains down to the edge of the Indo-Gangetic Plain.

There was no economically significant mineral production in the country during 1980. The rugged upland regions have not been thoroughly explored for mineral occurrences, and the potential for both metallic and nonmetallic mineral production is excellent. High-grade veins of copper were worked by hand in ancient times and some were still being operated at the present. A typical operation would mine and smelt 500 to 1,000 kilograms of copper per year. Nepalese weapons were historically produced from domestic iron ores, which were concentrated by crude magnetic separation.

Currently, the most attractive prospects lie in development of magnesite, limestone, dimension stone, and zinc. Mineral exploration and mining of mineral deposits could provide significant employment opportunities in rural areas. Most of the population was only partly employed because the crowded agricultural situation does not provide full employment.

GDP at current prices was estimated at $2 billion for fiscal year 1979-80.[29] The agricultural sector accounts for about 66% of the GDP and employed over 90% of the work force. Three successive crop failures, caused by poor weather conditions, played havoc with the economy and resulted in an overall drop in real GDP.

The budget for 1980-81 was directed toward improving the economic condition of the rural population, and the success of the program depends heavily on foreign assistance. Spending was expected to total nearly $408 million, of which development expenditure was allotted more than $283 million, an increase of over 45% over that of the previous year. Domestic revenue was estimated at $200 million, and a further 167 million, nearly 60% of development expenditure, was expected from foreign funding including grants and loans from international financial institutions.[30]

During fiscal year 1979-80, regular spending was allotted $100 million, an increase of 14.7%; development spending, $196 million. Serious problems were encountered on the revenue side. Domestic revenues actually declined a small amount. A large part of the income loss resulted from the contraction of volume of imports. Duties on many of Nepal's major imports, petroleum for example, were levied on volume, despite the frequently large increase in value.

Revenue, however, for the first quarter of fiscal year 1980-81 increased by 35% compared with the corresponding period in fiscal year 1979-80. As a result of better crop conditions, the agricultural-based industry and exports of sideline products were expected to show a significant improvement by the end of fiscal year 1980-81.

Nepal's trade situation deteriorated during fiscal year 1979-80 with the trade deficit increasing 43% over that of fiscal year 1978-79. Provisional data indicated total value of exports declined from $108 million in fiscal year 1978-79 to $80 million in fiscal year 1979-80. Imports increased from $240 million to $296 million in the same period.

The main thrust of the Government's economic program was to expand infra-

structure and develop the rural sector. Road construction has been continuing at a steady pace, and many areas are being linked by motorable roads for the first time. The new roads will permit access to areas that contain promising indications of economic mineralization but were formerly inaccessible to modern drilling equipment. Most of the road projects during the last decade have been constructed with the help of foreign technology and financing from India, China, the United Kingdom, the Soviet Union, and the United States. During the sixth plan period, 1,950 kilometers of new roads were to be built; 672 kilometers of blacktop, 775 kilometers of gravel, and 503 kilometers of motorable mud roads.

One of Nepal's greatest natural resources was its many fast-flowing streams. Nepal occupies only 0.09% of the world's total land area but, because of the high rainfall, snowmelt, and geographic relief, it possesses 2.67% of the world's total hydroelectric generating potential. Theoretically, over 80 million kilowatts of power could be developed.

During the past 5 years, peak demand for electric power has increased by 15% per year. Construction of new generating capacity, however, has not kept up with demand. In 1980, growing electrical energy shortages became acute, particularly in metropolitan Kathmandu where very unpopular load shedding was initiated throughout the area.

To relieve the problem, the Government turned to an accelerated construction schedule on the Kulekhani Dam and a 60,000-kilowatt powerplant. The project was about 60% complete in 1980 and was scheduled for startup in November 1981. Construction of the $95 million project, under contract to a South Korean firm, was being financed by the World Bank, the Japanese Government, and the United Nations Development Program.

Designing and survey work for the $72 million Marsyangdi hydroelectric powerplant was underway in fiscal year 1979-80. Construction was scheduled to begin in fiscal year 1980-81, subject to the availability of foreign financial assistance. The project consists of a small dam on the Marsyangdi River that would divert water through a 7-kilometer tunnel into a 50,000-kilowatt powerplant. A 132-kilovolt transmission line will feed the central power grid. Scheduled completion was in 1984.

In addition, a series of small, local hydroelectric generators, from 25 kilowatts to 1,000 kilowatts in size, were being built to supply outlying villages that were not included in present or planned distribution lines. Four were completed in 1980 and 12 more were under construction during the year.

India and Nepal were discussing a regional agreement for construction of a $1.5 billion dam on the Karnali River. The 3,600,000-kilowatt powerplant would be one of the largest in south Asia and require funding by a consortium of world financial organizations. The power would be mostly exported to India and furnish a source of foreign exchange to the Nepal treasury.

A third cement plant was planned as a joint venture. India would hold 49% equity in a 1,500-ton-per-day plant to be constructed at Udaypur in the southeast part of the country. A survey for the rail link from India into Udaypur to service the plant was completed. A detailed project report, completed in early 1980, won wide acceptance by officials of both countries and construction may begin in 1981.

In addition to the limestone quarrying, there was a small marble industry in the Godawari area. The marble was quarried then cut into ashtrays, mortars and pestles, and paperweights. Part of the output was exported to India and Bangladesh. Although the production was of relatively low value and tonnage, the overall operation employed over 500 persons.

Nepal Orind Magnesite Private Ltd. published tender offers for construction of various sections of the 175- to 200-ton-per-day dead-burnt sinter plant during 1980. The company was formed though collaboration between the Nepal Government and Orissa Industries Ltd. of India to exploit the magnesite deposits of Dolakha, east of Kathmandu. Harbison-Walker Refractories Co. of the United States was to supply technical know-how for the $20 million project.

The plant was to be built at Lamusangu, and magnesite was to be supplied by aerial cableway from the mine at Khoridhunga. A 20,000-ton-per-year refractory products plant was also planned and will be located at Birganj. At least 12 million tons of (44.0% to 46.0% MgO) magnesite has been proved and total reserves were estimated at 180 million tons.

COMMODITY REVIEW

The value of cement produced was probably more than the total output value of all minerals or mineral products in Nepal dur-

ing 1980. The demand for cement exceeded production, and prices varied substantially depending on the source. The price of Indian cement was 69 rupees per bag; domestic cement was 76 rupees; Japanese, 86 rupees; and Korean imports, 110 rupees per bag.

Again, problems with raw materials, spare parts, and maintenance contributed to the Himal cement plant not operating at designed capacity during 1980. Actual output has never exceeded 86% of the design capacity of the plant.

The Federal Republic of Germany was to provide grant assistance worth 5 million Deutsche marks to cover part of the cost of increasing the plant's output. It was planned to increase the daily capacity from 160 to 400 tons.

The country's second cement facility was currently under construction. Hetauda Cement Industries Ltd.'s plant has a designed capacity of 750 tons per day. The Asian Development Bank was helping finance the $60 million project. Limestone will be mined nearby at Bhaise and transported to the plant via a 13-kilometer aerial tramway. Construction was behind schedule in 1980 and the planned completion date in early 1981 was not likely to be met.

Nepal Metal Co. Ltd. offered 4.2 million rupees worth of common stock to Nepalese investors in January 1980. The company was set up to exploit the zinc and lead ore around Lari in Rasuwa District. Nepal Metal will be a joint venture of Nepal investors (50%), Hyderabad Asbestos Cement Products Ltd. (India) (25%), and Golder Moffitt and Associates Ltd. (England) (25%).

The company planned to mine zinc-lead ore exposed in the Ganesh Himal region 58 kilometers north-northwest of Kathmandu at an altitude of 4,419 meters (14,500 feet). The ore, which reportedly contains 11.87% zinc and 1.66% lead, will be concentrated at Somdang about 5 kilometers south of the mine and about 1,219 meters (4,000 feet) lower. The estimated 25,000 tons per year of concentrate would be exported. Production was scheduled to begin in 1984. The Government reportedly began construction of a motorable road from Betrabati to Somdang in order to bring in equipment and to ship out metal concentrates. This would be the first modern metal mine in Nepal.

Nepal has no domestic petroleum production and has no refinery capacity. Consumption of petroleum products was increasing rapidly because of increased electrical generation, increased tourism, and the increased use of kerosine instead of firewood in household uses (due to rapid depletion of forest resources).

The petroleum import bill totaled about $60 million in fiscal year 1979-80. Crude oil and products were contracted for delivery to India from Iraq, the U.S.S.R., and China. The crude oil was refined in India for Nepal's use. As prices rose in the world market, the Nepalese Government was forced to increase prices on gasoline (19%), diesel oil (35%), and kerosine (43%) during fiscal year 1979-80.

Nepal's total oil requirement for 1981 was around 300,000 tons. Early in 1980, there were temporary shortages in Nepal because refinery labor problems in India forced closure of the plants that normally supply the Nepalese market. Alternate arrangements were made and the normal supply resumed in April 1980.

To prevent temporary supply problems from causing economic hardship, the Nepal Oil Corp. was to begin a substantial expansion of its petroleum storage capacity. Standby capacity at four major sites would be increased by a total of 10,000 kiloliters. Total storage for the major cities was to be more than doubled.

SINGAPORE[31]

Singapore's economy continued to be service-oriented; services and trade accounted for 71% of the GDP. The share of the manufacturing sector to GDP was 24%. The sectors with the highest growth rates in 1980 were manufacturing, transport and communications, utilities, business services, and construction, in that order. By industrial production, output by the petroleum sector in 1980 was valued at $3.5 billion; electronics, $1.5 billion; transport equipment and oil rigs, $0.7 billion; and food, $0.6 billion. The fastest growing manufacturing subsector was metal engineering, in which output grew by 32%. This manufacturing grouping included machine tools, industrial machinery, tools and dies, and precision metal parts.[32] The value of cement produced in 1980 was $86 million; granite, $11 million; other nonmetallic mineral products, $43 million; iron and steel, $88 million; and nonferrous metals, $26 million.[33]

Singapore has three tin smelters, which rely on foreign concentrates. The oldest smelter, owned by Kin Hok, has a rated metal production capacity of 150 tons per month. The combined tin metal output of Kimetal Pty. Ltd. and Watson Mineral Enterprises was reportedly 750 tons per month. There has been controversy concerning the origin of the tin concentrates and whether the smelters are conduits for smuggled, incoming concentrates.[34]

After Houston and Rotterdam, Singapore is the third leading oil refining center with a 1.1-million-barrel-per-day capacity. Also, it is the second leading offshore rig-building nation in the world with major rig and tanker repair facilities. Singapore is the most important offshore oil exploration base in Asia and manufactures some drilling equipment. Shell Oil Co., Singapore Refining Co., Esso, Mobil Oil Co., and British Petroleum Co. (BP) each have refineries in Singapore. BP, the smallest refinery of the five, was the only company not planning to expand its present facilities. In addition, the Economic Development Board, the Government's investment incentive agency, was discussing the possibility of a sixth refinery.[35]

In 1980, Singapore's total trade was valued at $43.3 billion (imports, $23.9 billion and exports, $19.4 billion). The country's largest trade partners were the United States, Japan, and Malaysia, each accounting for about 13% of Singapore's total trade. Principal commodity imports in 1980 were crude petroleum, $5.7 billion; office machines and other electrical machinery, $1.7 billion; petroleum products, $1.3 billion; and miscellaneous machinery and equipment, $1.0 billion. Singapore's major exports were petroleum products, $5.5 billion; crude rubber, $1.5 billion; office machines and other electrical machinery, $1.5 billion; and telecommunications apparatus, $1.3 billion.

Table 7.—Singapore: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide	1,425	882	--	Malaysia 880.
Metal including alloys:				
Scrap	4,228	22,517	39	Japan 20,713; Pakistan 927.
Unwrought and semimanufactures	7,245	7,083	7	Malaysia 4,139; Republic of Korea 752; Thailand 715.
Antimony metal including alloys, all forms	NA	80	--	India 60; Malaysia 18.
Cadmium metal including alloys, all forms kilograms	NA	113	--	Mainly to Malaysia.
Chromium oxide and hydroxide	66	34	--	Malaysia 26.
Cobalt:				
Oxide and hydroxide	3	24	--	Mainly to North Korea.
Metal including alloys, unwrought	NA	2	--	All to North Korea.
Copper:				
Sulfate	385	NA	NA	NA.
Matte	NA	5	--	All to Japan.
Metal including alloys:				
Scrap	9,896	15,543	1	India 8,372; Republic of Korea 2,313; Japan 1,860.
Unwrought and semimanufactures	4,055	6,353	NA	Malaysia 4,466.
Iron and steel:				
Ore and concentrate value	$22,513	$540	--	All to Malaysia.
Metal:				
Scrap	3,745	1,710	--	Malaysia 893; Japan 718.
Pig iron, ferroalloys, similar materials	6,143	12,046	--	Malaysia 11,455.
Steel, primary forms	7,982	6,915	NA	Malaysia 5,917.

See footnotes at end of table.

Table 7.—Singapore: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	122,021	122,262	4	Malaysia 65,097; Hong Kong 12,423; United Arab Emirates 11,298.
Universals, plates, sheets	97,222	111,598	21	Malaysia 88,568; Burma 3,866; Brunei 3,189.
Hoop and strip	3,230	4,724	NA	Malaysia 4,302.
Rails and accessories	2,193	9,285	--	Malaysia 9,166.
Wire	6,807	4,961	NA	Malaysia 3,844.
Tubes, pipes, fittings	[1]259,660	63,059	662	Malaysia 18,052; Brunei 5,809.
Castings	438	412	230	Malaysia 135.
Lead:				
Ore and concentrate	34	62	--	West Germany 60.
Oxide	244	398	--	Malaysia 396.
Metal including alloys:				
Scrap	2,642	3,311	1	Taiwan 2,198; Malaysia 633.
Unwrought and semimanufactures	632	965	([2])	Malaysia 685; Thailand 155.
Magnesium metal including alloys, unwrought ---- kilograms	10,015	417	--	All to Brunei.
Manganese:				
Ore and concentrate	18,501	20,706	--	India 4,823; Kenya 3,200; Malaysia 2,929; Thailand 2,685.
Oxide	596	1,172	--	Malaysia 793; Bangladesh 213; Thailand 100.
Mercury ---- 76-pound flasks	36	23	--	Malaysia 15; Sri Lanka 5.
Nickel metal including alloys:				
Scrap	409	379	4	Japan 359; Taiwan 12.
Unwrought and semimanufactures	159	334	--	India 219; Malaysia 89.
Platinum-group metals including alloys, unwrought and wrought troy ounces	161	64	--	Australia 32; Malaysia 32.
Silver metal including alloys:				
Waste and sweepings[3] -- kilograms	6,126	29,519	2,838	Malaysia 25,302.
Unwrought and wrought troy ounces	643	93,205	--	Malaysia 40,381; Hong Kong 35,912.
Tin:				
Ore and concentrate	8,271	6,382	20	U.S.S.R. 2,100; Brazil 1,571; Spain 1,540.
Oxide and hydroxide ---- kilograms	10	936	--	Malaysia 885.
Metal including alloys:				
Scrap	94	131	21	Taiwan 100.
Unwrought and semimanufactures	7,876	11,002	6,272	Taiwan 486; Hong Kong 485; Malaysia 219.
Titanium:				
Ore and concentrate	NA	55	--	Mainly to Hong Kong.
Oxides	536	630	--	Malaysia 627.
Tungsten:				
Ore and concentrate	440	397	54	North Korea 138; Netherlands 51; West Germany 48.
Metal including alloys, all forms	57	85	50	Republic of Korea 15.
Zinc:				
Ore and concentrate ---- value	$2,444	$616	--	All to Malaysia.
Oxide and peroxide excluding hydroxide	1,277	1,306	--	Japan 808; Malaysia 215; Nigeria 120.
Metal including alloys:				
Scrap	734	1,018	--	Taiwan 497; Japan 207; Malaysia 167.
Unwrought and semimanufactures	8,331	3,149	--	Malaysia 2,994.
Other:				
Ash and residue containing nonferrous metals	8,643	12,111	11	Malaysia 5,810; Brunei 3,729; Netherlands 1,167.
Oxides, hydroxides, peroxides	168	93	--	Malaysia 41; Japan 13; Thailand 13.
Metals:				
Metalloids	21	29	--	Malaysia 28.
Alkali, alkaline earth, rare-earth metals ---- kilograms	[r]3,485	378	--	Malaysia 172; Brunei 150.
Pyrophoric alloys	3	3	--	Mainly to Malaysia.
Base metals including alloys, all forms	228	([2])	NA	NA.

See footnotes at end of table.

Table 7.—Singapore: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural: Emery, pumice, corundum	30	111	--	Malaysia 93.
Artificial corundum ... kilograms	8,170	470	--	All to Republic of Korea.
Dust and powder of precious and semiprecious stones ... value	--	$11,155	$578	Hong Kong $10,577.
Grinding and polishing wheels and stones[4]	340	431	(2)	Malaysia 342.
Asbestos	5,901	9,535	--	Malaysia 9,321.
Boron materials: Crude natural borates	45	275	--	All to Malaysia.
Cement	346,894	431,989	--	Malaysia 181,964; Thailand 69,953; Tanzania 45,551.
Chalk	220	1,312	--	Brunei 1,044; Malaysia 268.
Clays and clay products including all refractory brick:				
Crude clays:				
Bentonite	NA	21,600	--	Philippines 8,059; Brunei 7,194; United Arab Emirates 2,250.
Fuller's earth	265	5,066	--	Malaysia 5,037.
Kaolin (china clay)	1,539	1,613	--	Malaysia 1,563.
Other	r21,451	4,641	--	Philippines 2,745; Malaysia 1,440.
Products:				
Refractory including nonclay brick	619	5466	--	Malaysia 460.
Nonrefractory[6]	10,151	14,536	6	Malaysia 12,069.
Diamond:				
Gem, not set or strung value, thousands	r$3,849	$6,322	$30	Hong Kong $3,159; Japan $1,180; Belgium-Luxembourg $461.
Industrial ... do	$12	$345	--	Hong Kong $134; Kuwait $75; Belgium-Luxembourg $56.
Diatomite and other infusorial earth	11	60	--	Malaysia 44; Philippines 9; Thailand 6.
Feldspar and fluorspar	4,008	4,941	--	Malaysia 4,937.
Fertilizer materials:				
Crude:				
Nitrogenous	185	1	--	All to Malaysia.
Phosphatic	13,019	12,465	--	Malaysia 10,860; Taiwan 1,444.
Manufactured:				
Nitrogenous	50,606	36,701	--	Malaysia 36,606.
Phosphatic	76,065	28,946	--	Bangladesh 21,500; Malaysia 3,861; Burma 3,100.
Potassic	203,616	234,167	NA	Malaysia 144,454; Bangladesh 66,244.
Other including mixed	97,006	122,860	--	Malaysia 122,059.
Ammonia	259	381	--	Malaysia 303.
Graphite, natural	20	75	--	Malaysia 60; Republic of Korea 15.
Gypsum and plasters	881	1,405	--	Malaysia 849; Hong Kong 288; Taiwan 147.
Lime	3,811	5,574	--	Malaysia 2,381; Sri Lanka 2,425.
Magnesite	50	102	--	All to Malaysia.
Mica, all forms	15	153	--	Brunei 105; Philippines 30.
Pigments, mineral:				
Natural, crude	1	200	--	All to Malaysia.
Iron oxides, processed	339	427	--	Malaysia 420.
Precious and semiprecious stones, natural and synthetic, excluding diamond value, thousands	$19,604	$26,390	$353	Hong Kong $21,697; Switzerland $1,185; Japan $565.
Salt and brine	17,029	14,131	--	Malaysia 10,974; Oman 2,410.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	3,675	10,893	--	Malaysia 9,152; India 309.
Caustic potash	648	258	--	Malaysia 231.
Soda ash	7,912	5,939	--	Malaysia 5,540; Thailand 200.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	602	426	--	Malaysia 419.
Worked[7]	560	1,726	3	Malaysia 1,502.
Dolomite, chiefly refractory grade	--	2,494	--	Papua New Guinea 2,478.
Gravel and crushed rock	4,529	4,315	--	Brunei 2,700; Malaysia 1,603.
Limestone	681	666	--	Mainly to Malaysia.
Quartz and quartzite	(4)	3	--	Do.
Sand excluding metal-bearing	1,640	1,355	NA	Australia 1,082; Brunei 114.
Sulfur:				
Elemental:				
Other than colloidal	14,137	5,190	--	Malaysia 4,734.
Colloidal, sublimated and precipitated	4,905	16,068	--	Malaysia 15,557.
Sulfur dioxide ... kilograms	608	420	--	Malaysia 400.

See footnotes at end of table.

Table 7.—Singapore: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sulfur —Continued				
Sulfuric acid	1,458	804	--	Brunei 564; Philippines 112.
Talc, steatite, soapstone, pyrophyllite	735	807	--	Malaysia 800.
Other:				
Crude	52,937	64,165	--	Malaysia 60,331.
Slag, dross, and similar waste, not metal-bearing	1,355	113,858	--	Japan 5,500; Taiwan 3,726; Malaysia 1,924.
Oxides and hydroxides of magnesium, strontium, barium	12	14	--	Mainly to Malaysia.
Bromine, iodine, fluorine ---value	$4,997	$12,812	--	Malaysia $3,166; Philippines $2,922; Sri Lanka $2,494.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	12,008	17,973	--	Malaysia 6,865; Sri Lanka 3,688; Hong Kong 2,298.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,007	26,478	3	Bangladesh 16,112; Burma 8,199; Malaysia 1,732.
Carbon black	418	690	--	Malaysia 465; India 225.
Coal, all grades including briquets	298	1,038	--	Philippines 537; Malaysia 330.
Coke and semicoke	7,002	8,242	--	Malaysia 7,766; Bangladesh 410.
Hydrogen, helium, rare gases value, thousands	$457	$1,161	--	Malaysia $608; Brunei $228; Taiwan $70.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	r661	907	36	Malaysia 871.
Refinery products:				
Gasoline:				
Aviation---do	467	390	--	Australia 102; Papua New Guinea 94; New Zealand 61.
Motor ---do	8,330	13,561	--	Malaysia 2,956; Thailand 1,090.
Jet fuel ---do	12,663	17,119	4,644	Japan 4,253; Hong Kong 1,797; New Zealand 1,467.
Kerosine and white spirit do	7,091	6,829	500	Hong Kong 2,690; Malaysia 1,127; India 751.
Distillate fuel oil ---do	26,884	30,435	--	Thailand 6,845; Malaysia 6,143; Australia 3,254.
Residual fuel oil---do	53,899	56,929	1,765	Hong Kong 20,367; Japan 15,181; Australia 7,823.
Lubricants ---do	r3,160	3,791	(2)	Malaysia 740; Thailand 723; Republic of Korea 566.
Other:				
Mineral jelly and wax do	294	345	--	Japan 67; Taiwan 36.
Naphtha ---do	19,044	18,779	--	Japan 15,144; New Zealand 1,106.
Nonlubricating oils -do	r75	580	(2)	Sweden 260; Thailand 187; Malaysia 59.
Pitch and petroleum coke do	4	84	--	United Arab Emirates 45; New Caledonia 13.
Bitumen and bituminous mixtures, n.e.s ---do	1,368	1,423	--	Australia 313; Bangladesh 167; Vietnam 111.
Unspecified---do	r8,338	7,149	(2)	Japan 4,777; Philippines 1,385.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,915	4,319	--	Taiwan 3,574; Malaysia 610.

rRevised. NA Not available.

[1]Excludes unreported quantity of conduit tubes valued at $213,766 in 1978.

[2]Less than 1/2 unit.

[3]May include platinum-group metals.

[4]Excludes quantities valued at $131,938 in 1978 and $14,565 in 1979.

[5]Excludes quantity valued at $32,093.

[6]Excludes quantity valued at $88,658 in 1978 and $60,488 in 1979.

[7]Excludes quantity valued at $507 in 1978 and $115 in 1979.

Table 8.—Singapore: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Bauxite and concentrate	7,242	11,000	--	Malaysia 10,400; China, mainland 600.
Oxide and hydroxide	4,460	7,583	255	Japan 5,293; China, mainland 1,838.
Metal including alloys:				
Scrap	399	334	NA	Malaysia 250; Brunei 62.
Unwrought and semimanufactures	r24,219	28,739	3,253	Japan 3,871; Australia 3,821; Belgium-Luxembourg 2,273; Thailand 1,964.
Antimony metal including alloys, all forms	NA	14	--	Mainly from China, mainland.
Arsenic, natural sulfides	1	2	--	All from Belgium-Luxembourg.
Beryllium metal including alloys, all forms kilograms	40	26	15	Japan 11.
Bismuth metal including alloys, unwrought do	NA	2,310	2,310	
Cadmium metal including alloys, unwrought	NA	5	--	Mainly from Australia.
Chromium oxides and hydroxides	114	163	36	Finland 34; West Germany 28; United Kingdom 22; Japan 19.
Cobalt:				
Oxide and hydroxide	6	25	4	Japan 8; Belgium-Luxembourg 5; Canada 3.
Metal including alloys, unwrought kilograms	NA	2,290	--	Japan 2,000; United Kingdom 290.
Columbium and tantalum metals including alloys, all forms do	17	8,187	6	Malaysia 8,181.
Copper:				
Ore and concentrate	--	1	--	Mainly from Japan.
Matte value	--	$40	--	All from Australia.
Metal including alloys:				
Scrap	1,561	3,060	1	Malaysia 2,267; United Arab Emirates 250; Brunei 208.
Unwrought and semimanufactures	r18,184	23,832	900	Japan 13,300; Australia 5,141; New Zealand 780.
Indium metal including alloys, unwrought	NA	20	--	All from United Kingdom.
Iron and steel:				
Ore and concentrate	16,459	6,781	--	Malaysia 6,777.
Metal:				
Scrap	92,940	109,055	54,952	Australia 46,481; Malaysia 3,856.
Pig iron including cast iron	55,807	79,862	47,169	Sweden 16,200; Australia 9,075.
Sponge iron, powder, shot	832	1,266	460	Japan 366; Malaysia 334.
Ferroalloys:				
Ferromanganese	2,143	6,328	--	Australia 6,152.
Other	3,920	1,409	10	Australia 336; Philippines 210; Republic of Korea 200; Taiwan 181.
Steel, primary forms	63,784	110,990	46	Mozambique 32,839; Republic of Korea 29,816; Japan 16,422.
Semimanufactures:				
Bars, rods, angles, shapes, sections	271,509	246,862	3,318	Japan 86,211; Mozambique 60,218; West Germany 22,911; Taiwan 17,742.
Universals, plates, sheets	611,548	611,132	5,417	Japan 440,557; Republic of Korea 63,809; Mozambique 44,348.
Hoop and strip	r32,374	30,545	575	Japan 21,293; Republic of Korea 4,479; Australia 2,058.
Rails and accessories	9,275	34,010	1,638	Taiwan 9,994; Switzerland 6,699; Japan 5,969; Belgium-Luxembourg 5,108.
Wire	16,787	18,122	199	Japan 6,603; China, mainland 6,332; Taiwan 980.
Tubes, pipes, fittings	r 1249,513	291,030	8,491	Japan 236,039; India 10,721; Malaysia 8,114.
Castings and forgings, rough	6,284	10,246	3,810	Japan 5,067; Australia 986.
Lead:				
Ore and concentrate	38	114	--	Thailand 60; Australia 54.
Oxide	589	497	(2)	Australia 424; West Germany 41; China, mainland 30.
Metal including alloys:				
Scrap	664	235	--	Malaysia 111; Brunei 81; Japan 40.
Unwrought	4,560	4,373	12	Australia 2,951; Malaysia 650; Burma 200.
Semimanufactures	r696	911	19	Australia 624; Taiwan 67; United Kingdom 42.
Magnesium metal including alloys, all forms	47	22	2	Japan 19.

See footnotes at end of table.

Table 8.—Singapore: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Manganese:				
Ore and concentrate	44,980	33,517	--	NA.
Oxide	2,319	2,767	--	Ireland 1,962; China, mainland 312; Japan 312; India 150.
Mercury 76-pound flasks	121	116	7	Japan 76; China, mainland 20.
Molybdenum metal including alloys, all forms	8	4	4	
Nickel metal including alloys:				
Scrap	31	55	--	Philippines 40; Malaysia 10.
Unwrought and semimanufactures	517	300	19	Canada 114; United Kingdom 63; Japan 23.
Platinum-group metals including alloys, unwrought and wrought troy ounces	1,414	5,466	4,694	Australia 514.
Silver metal including alloys:				
Waste and sweepings[3] kilograms	5,744	2,526	1	Malaysia 2,189.
Unwrought and wrought troy ounces	687,832	809,169	158,181	Australia 240,712; Hong Kong 153,295; Japan 86,485.
Tin:				
Ore and concentrate	3,118	4,227	--	Thailand 2,014; Burma 1,958.
Oxide and hydroxide	4	2	(2)	Mainly from Malaysia.
Metal including alloys:				
Scrap	60	156	85	Hong Kong 63.
Unwrought and semimanufactures	1,774	2,013	7	Malaysia 1,103; Hong Kong 415; United Kingdom 156.
Titanium:				
Ore and concentrate	55	782	--	All from Malaysia.
Oxide	3,420	4,338	584	Japan 1,652; West Germany 914; Australia 677.
Metal including alloys, unwrought kilograms	NA	1,423	465	United Kingdom 528; Japan 400.
Tungsten:				
Ore and concentrate	405	486	(2)	Burma 268; Thailand 207.
Metal including alloys, all forms	54	76	3	Republic of Korea 54; Japan 10.
Zinc:				
Ore and concentrate value	$240	$5	--	Mainly from Burma.
Oxide and peroxide excluding hydroxide	432	397	1	United Kingdom 138; China, mainland 61; Malaysia 56.
Metal including alloys:				
Scrap	403	445	--	Malaysia 409.
Blue powder	405	NA	NA	NA.
Unwrought and semimanufactures	18,253	18,038	190	Canada 8,011; Australia 4,148.
Zirconium ore and concentrate	155	377	(2)	Australia 207; Malaysia 170.
Other:				
Ash and residue containing nonferrous metals	37,380	104,240	--	Japan 97,000; Malaysia 6,655.
Oxides, hydroxides, peroxides	432	670	56	Norway 130; China, mainland 128; United Kingdom 114; West Germany 111.
Metals:				
Metalloids	21	26	1	Japan 21.
Alkali, alkaline-earth, rare-earth metals	39	64	(2)	West Germany 50; Japan 12.
Pyrophoric alloys	33	81	(2)	China, mainland 69; Austria 6; Hong Kong 3.
Base metals including alloys, all forms	321	8	(2)	Mainly from Malaysia.
NONMETALS				
Abrasives, natural, n.e.s.:				
Natural: Pumice, emery, corundum, etc	221	293	153	United Kingdom 22; New Zealand 20; India 19.
Dust and powder of precious and semiprecious stones value	$2,365	$406,358	$270,000	Hong Kong $130,962.
Grinding and polishing wheels and stones[4]	1,239	1,456	37	Japan 711; Taiwan 231; Italy 149.
Asbestos	9,168	12,008	672	Australia 6,124.
Barite and witherite	14,858	50,774	2,000	Thailand 43,472; India 3,000.
Boron materials: Crude natural borates	204	628	628	
Cement thousand tons	1,636	1,682	4	Japan 1,272; Republic of Korea 316.
Chalk	1,046	3,741	NA	Malaysia 2,401; United Kingdom 722.

See footnotes at end of table.

Table 8.—Singapore: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products including all refractory brick:				
Crude clays:				
Bentonite	NA	46,377	45,117	Netherlands 900.
Fuller's earth	4,721	3,187	48	China, mainland 2,296; Japan 722.
Kaolin (china clay)	4,802	5,983	184	Malaysia 3,754; Japan 1,431; United Kingdom 533.
Other	r46,021	18,307	1,181	Malaysia 9,113; Japan 2,729; Austria 1,993; United Kingdom 1,964.
Products:				
Refractory including nonclay brick	10,411	r7,067	85	United Kingdom 2,394; Japan 2,214.
Nonrefractory[6]	r67,081	76,866	43	Italy 34,216; Japan 14,736; Malaysia 5,269.
Diamond:				
Gem, not set or strung value, thousands	$21,925	$36,043	$623	Israel $14,899; Belgium-Luxembourg $8,368; India $5,828.
Industrial do	$282	$2,015	--	Israel $651; Belgium-Luxembourg $481; Switzerland $421.
Diatomite and other infusorial earth	320	657	569	Japan 49; Philippines 22.
Feldspar and fluorspar	5,503	5,829	1	India 5,021; China, mainland 587.
Fertilizer materials:				
Crude, phosphatic	14,108	17,090	--	China, mainland 4,760.
Manufactured:				
Nitrogenous	74,484	67,219	5,035	West Germany 38,301; Italy 12,072.
Phosphatic	r111,575	53,217	50,309	Israel 2,808.
Potassic	247,697	297,644	11,878	Canada 162,593; Israel 60,365; West Germany 52,082.
Other including mixed	105,879	119,008	4,101	West Germany 90,403; Belgium-Luxembourg 24,276.
Ammonia	409	542	30	Japan 213; Malaysia 188.
Graphite, natural	151	519	31	China, mainland 225; Sri Lanka 154; Republic of Korea 97.
Gypsum and plaster	71,003	75,268	5	Australia 51,285; Japan 21,796.
Kyanite and sillimanite value	NA	$145	--	All from Netherlands.
Lime	16,293	14,373	5	Malaysia 13,938.
Magnesite	180	288	13	Norway 125; China, mainland 82.
Mica, all forms	318	309	58	India 183; Japan 29.
Pigments, mineral:				
Crude, natural	136	33	NA	West Germany 18; China, mainland 15.
Iron oxides, processed	1,686	2,266	170	West Germany 733; China, mainland 607; Japan 566.
Precious and semiprecious stones, except diamond, worked and unworked:				
Natural value, thousands	$17,196	$26,971	$125	Kenya $19,607; Hong Kong $2,073.
Manufactured do	$247	$105	--	Thailand $35; Japan $25.
Salt and brine	50,993	47,139	15	Taiwan 25,743; Australia 11,000; West Germany 5,840.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	13,653	30,103	7,939	Romania 7,410; West Germany 4,099; East Germany 3,494; Poland 2,425.
Caustic potash, sodic and potassic peroxides	800	592	10	Hong Kong 201; Japan 162; United Kingdom 141.
Soda ash	21,154	23,148	2	Kenya 17,641; Romania 4,578; East Germany 302.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	8,330	17,121	164	Malaysia 15,820.
Worked	15,750	11,406	176	Italy 6,675; China, mainland 2,758.
Dolomite, chiefly refractory grade	2,930	5,137	334	Malaysia 4,736.
Gravel and crushed rock	679,779	1,086,940	115	Malaysia 1,083,104.
Limestone excluding dimension	31,091	49,160	--	Malaysia 48,428.
Quartz and quartzite	2,527	948	16	Malaysia 799; West Germany 71; China, mainland 51.
Sand excluding metal-bearing	277,342	281,142	1,859	Malaysia 274,360.
Sulfur:				
Elemental:				
Other than colloidal	373	568	9	Taiwan 365; West Germany 103.
Colloidal	315	168	37	Taiwan 65; Poland 38; Thailand 20.
Sulfur dioxide kilograms	r6,684	1,266	1	United Kingdom 754; Australia 459.
Sulfuric acid	74	846	56	Malaysia 717.
Talc, steatite, soapstone, pyrophyllite	6,054	4,885	11	China, mainland 3,073; Republic of Korea 758.

See footnotes at end of table.

Table 8.—Singapore: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Other:				
Crude	99,689	101,436	40	West Germany 95,342; Malaysia 5,447.
Slag, dross, and similar waste, not metal-bearing	2,653	9,590	--	Japan 5,100; Taiwan 2,320.
Oxides and hydroxides of magnesium, strontium, barium	109	57	9	Japan 34; West Germany 8.
Bromine, iodine, fluorine ___ value	$21,312	$39,618	$18,788	Japan $10,737; West Germany $5,375.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	3,557	7,615	4	Malaysia 4,750; Japan 379.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,318	2,022	820	Republic of Korea 770; United Kingdom 400.
Carbon black	4,664	6,293	194	Malaysia 3,508; Japan 2,008.
Coal, all grades, including briquets	2,345	1,148	1,087	Japan 49.
Coke and semicoke	12,796	9,261	10	Japan 6,850; Taiwan 1,970.
Hydrogen, helium, rare gases value, thousands	$445	$530	$133	Japan $117; Australia $90; United Kingdom $89.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	r203,248	207,939	--	Saudi Arabia 108,027; Kuwait 38,265; Iraq 30,616.
Refinery products:				
Gasoline:				
Aviation do	503	377	--	Netherlands Antilles 164; Iran 132.
Motor do	147	116	--	Bahrain 73; Philippines 35.
Jet fuel do	7NA	49	(2)	Mainly from China, mainland.
Kerosine and white spirit do	r527	289	(2)	Malaysia 287.
Distillate fuel oil do	1,807	2,147	--	Bahrain 935; China, mainland 637; Australia 575.
Residual fuel oil do	16,933	22,621	(2)	Bahrain 9,957; Iran 6,674; Kuwait 900.
Lubricants do	r739	10,125	5,144	United Kingdom 840; New Zealand 821; China, mainland 736; Republic of Korea 618.
Other:				
Mineral jelly and wax do	35	62	2	Burma 28; China, mainland 26.
Nonlubricating oils, n.e.s. do	r41	58	11	Malaysia 12; China, mainland 7; Japan 5.
Pitch and petroleum coke do	27	37	23	Australia 8.
Bitumen and bituminous mixtures do	15	23	12	Thailand 6.
Unspecified do	r2,838	2,444	3	Malaysia 1,208; United Arab Emirates 154; Thailand 63.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	3,098	3,390	31	United Kingdom 1,853; Australia 775; Japan 555.

rRevised. NA Not available.
[1]Excludes unreported quantity valued at $1,599,515 imported in 1978.
[2]Less than 1/2 unit.
[3]May include platinum-group metals.
[4]Excludes quantities valued at $354,381 in 1978 and $43,656 in 1979.
[5]Excludes quantity valued at $5,984,544 imported in 1979.
[6]Total excludes bricks of baked clay valued at $505,548 in 1978 and $524,865 in 1979.
[7]Unreported quantity valued at $218 in 1978.

SRI LANKA[36]

The mining industry of Sri Lanka accounted for 3.5% of the GDP and 3.2% of total exports. New economic incentives involving the mining sector as well as other parts of industry and commerce have been a part of the Government's renewed plan for economic recovery.

The major economic problem during 1980 was the drastic rise in the inflation rate—reportedly between 25% and 30% by July, and estimated by a Government official to reach 100% by the end of 1983. A second serious problem was the lack of new sources of financial aid as skyrocketing costs used up previously committed funds before projects were completed.

The three main projects were the massive Mahaweli River diversion project, the Greater Colombo redevelopment project, and the free-trade zone run by the Greater Colombo Economic Commission. Commercial loans were being considered as a source of financial support with the drying up of funds from international aid agencies.

The accelerated development program was begun in 1977 and at first was plagued by problems including inadequacy of equipment and a shortage of skilled personnel and construction materials. In 1980, the Government encountered an inordinate increase in fuel prices, which imposed severe restrictions on financial resources. The cost of imported oil was 3.3 billion rupees (Rs)[37] during the first half of 1980 compared with Rs1.2 billion for the same period in 1979. Efforts to hold down the volume of oil imported met with little or no success as demands of the construction projects and oil-fueled electricity generation forced increased imports.[38]

New incentives for economic recovery were begun in June 1980 and included a 5-year tax holiday for all companies involved in the Mahawela River scheme, and in the industrial sector, the same tax holiday to public companies considered essential to the country's economic progress. Tax concessions were made to the gem and jewelry industry from mines to exporters. These concessions were expected to ensure better prices to gem miners while promoting the export jewelry trade.[39]

In the 1977 economic liberalization, the value of the Sri Lankan rupee was set at Rs16.0=U.S.$1.00. During 1980, the rupee was being slowly depreciated by the Central Bank and by yearend was slightly over Rs17=U.S.$1.00. Although the Government did not admit the pegged devaluation, exporters stopped forward exchange booking, and the exercise seemed to demonstrate a willingness to trim imports by making them more expensive.

In June 1980, the International Development Association (IDA) approved $19 million credit for construction of energy transmission and distribution facilities. The accelerated Mahaweli Ganga Development Program, now constructing hydroelectric stations, will provide the electricity to be distributed throughout the country, enabling all sectors of the economy to benefit.

An increase in production was reported in the agricultural sector in 1980, coming mainly from a record domestic rice crop. Increases in dairy products, livestock production, and improved performances in fisheries also contributed to improvement in the food-producing sector.

Sri Lanka's exports were overwhelmingly agricultural in nature. Tea, rubber, and coconut together generally account for over 60% of total exports. In addition to the gem stone trade, the only other significant mineral-based export was petroleum products. These were surplus refinery end products such as heavy residual fuel oil and international bunkers for ships and aircraft. The petroleum value was substantial, accounting for 12.5% of export value in 1979.

Sri Lanka's imports were dominated by crude oil, but consumer goods and products used in the development projects were also important. The trade balance, which was in surplus 3 years ago, has since turned into deficit. In the first half of 1980, the trade gap reportedly was Rs7.7 billion, compared with a Rs4.2 billion deficit for the same period in 1979.

COMMODITY REVIEW

In mid-1980, the Sri Lankan Government concluded agreements with one native and seven foreign companies to mine gem stones from a total of 33,000 acres in Sabaragamuwa Province. This was the area expected to be submerged in mid-1984 by six reservoirs when the Mahaweli River irrigation and hydroelectric project was due for completion. The agreement provides for the firms to bring in the capital, know-how, technology, and machinery, and carry out the mining under the supervision of the Government-owned State Gem Corp. (SGC). The

royalty payments were individually negotiated and ranged from 5% to 20% of value. In addition, all of the companies agreed to a 50-50 split of all profits earned. The SGC will have first option on the purchase of all finds. Ruby and sapphire were the major stones, but cat's-eye and alexandrite also occur in the mining area.

Until 1980, gem mining in Sri Lanka, while an important money earner for the country, had been a primitive, one-person or family operation, using the traditional wash pans, baskets, and shovels. Bulldozers, trench diggers, sifters, and other large earthmoving equipment will now be used to seek the placer gem stones. The gem stones are found in gravel-sized alluvium either in active streambeds or in former streambed material along the valley floors. The primary source of the gem stones has never been found.

The Government felt the mechanized mining projects would be a quick and practical way of recovering at least some of the gems that will be lost once the Mahaweli valleys are flooded, and also a means of setting up a national gem reserve. Building sizable stocks would enable the SGC to play a regulatory role in international gem markets, as well as boost Sri Lanka's international credit worthiness and provide exhibits for museums to attract tourists.

Gems reportedly worth 660 million rupees were exported in 1980. The target for gem exports in 1981 was 750 million rupees.[40]

A severe shortage of cement developed in 1980 because of the unusual amount of construction underway in the country. The shortage forced the import of substantial amounts of cement in order to keep the construction on schedule. There were three cement facilities in the country in 1980. Plants at Kankesantuarai and Puttalam produce and grind clinker. The plant at Galle only grinds clinker supplied by the other two plants. Total design capacity of the system was just over 700,000 tons per year. A large expansion project was underway during 1980. Scheduled for completion in 1982, the expanded capacity will reportedly produce a surplus of cement for export.[41]

The Sri Lankan Geological Survey Department conducted a yearlong uranium survey during 1980. Along five separate areas in the country, the geologists identified what were described as large deposits of uranium ore. An 8-month detailed survey was to commence in January 1981 to determine quantity, grade of ore, and the economic feasibility of mining the uranium deposits.

Sri Lankan graphite has a purity of 99% carbon when processed and lends itself to being ground down easily to submicrometer sizes, thus being particularly suitable for use in high-quality lubricants. During 1980, Indian collaboration was sought in developing graphite-based industries in Sri Lanka. Under the proposal, India would supply the plants, equipment, and know-how and train the local technicians. Among the products proposed were foundry mold release compounds, carbon brushes and collars for electrical equipment, graphite-based paints, high-quality graphite-based greases and lubricants, dry and chemical cell electrodes, and graphite crucibles.

The value of graphite exported during 1979 totaled $4.8 million, a more than 26% increase over the 1978 value.

Sri Lanka's first ammonia-urea facility was completed during 1980, but by yearend had not yet been brought onstream because of concern over its economic viability. The complex was located at Sapugaskanda, about 11 kilometers from Colombo, and consisted of a 147,000-ton-per-year N naphtha-based ammonia unit and a 143,000-ton-per-year N urea plant. The plant was designed and built by Kellogg Overseas Corp. at a cost exceeding $170 million. Until the expected 10,000-ton-per-month production level is realized, Sri Lanka will continue to import urea as well as ammonium sulfate from Japan.

Apatite was mined manually on a small scale and applied directly to crops without processing. The Government has been considering setting up a phosphate fertilizer plant at the Eppawela deposit but there was little progress toward start of construction during 1980.

Small-scale mining of mica has been underway in Sri Lanka for many years. Local cottage industry type manual mining operations were located in the Rattota District north of Kandy, Madugoda, and the Matale and Andiradhapura Districts. These local mines sell their product to the State Graphite Corp., which handles marketing and sales arrangements. During 1980, the State Graphite Corp. became the State Mining and Mineral Development Corp. and will presumably have an increasing interest in a wider range of Sri Lankan minerals.

At yearend 1980, seismic, magnetic, and

gravity surveys offshore northwestern Sri Lanka were undertaken for three U.S. firms by Prakla Seismos GmbH of the Federal Republic of Germany. The surveys were expected to be completed by early 1981. The efforts were on a production-sharing agreement whereby the concession holders would forego the capital invested in the survey if no petroleum was found. The contract for concession block 11 was held by Citco Sri Lanka Petroleum Corp., blocks 1 and 10 were jointly held by Aracca Petroleum Corp. and Sundance Oil Co., and block 2 was held by Seahawk International Inc. Past surveys carried out by the U.S.S.R. revealed potential reservoirs and cap rock in these areas.

Ceylon Petroleum Corp. (CPC) completed modifications at the country's only petroleum refinery early in 1980. The improvements removed bottlenecks in the Sapugaskanda flowsheet and will permit a 33% increase in refinery throughput. CPC had planned to install a $102 million hydrocracker in order to produce a better mix of middle-distillate products needed in the Sri Lankan economy. The present facility produces a large surplus of heavy residual fuel oils, which have only a small market in the country. Political and economic problems cropped up in late 1979, and construction did not begin on the project as scheduled. The project was under study during 1980 and was interrelated with the problem of startup at the adjacent fertilizer plant, which was designed to use naphtha feedstock at a time when naphtha sold at a much lower price. Events at the fertilizer plant could influence the profile of products desired from the CPC refinery.

Sri Lanka produced no crude oil or natural gas in 1980. It has traditionally relied on the Middle East countries for its crude oil imports. In 1980, however, an agreement was also reached with Indonesia for the purchase of 360,000 tons of crude oil, Sri Lanka's first purchase from outside the Middle East.

Table 9.—Sri Lanka: Exports and re-exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	(1)	7	--	Nepal 3; Malaysia 3.
Copper metal including alloys, all forms value	$4,800	$3,117	$782	India $1,547; Belgium $631; West Germany $147.
Iron and steel metal, all forms	17	7	--	India 5; Maldive Islands 2.
Lead:				
Oxide	480	452	--	Republic of South Africa 445; Bangladesh 7.
Metal including alloys, all forms	71	334	--	Republic of South Africa 245; Hong Kong 50; Bangladesh 39.
Platinum-group metals including alloys, unwrought and wrought value	--	$535	--	All to United Kingdom.
Silver metal including alloys, unwrought and wrought do	$8,438	$281	$24	West Germany $257.
Tin metal including alloys, all forms do	(1)	$5	--	Mainly to Netherlands.
Titanium ore and concentrate	40,700	32,640	(1)	Mainly to Japan.
Other:				
Ores and concentrates	r4,002	16,500	5,700	Republic of Korea 6,000; Belgium 3,500.
Ash and residue containing nonferrous metals kilograms	--	9	--	All to Japan.
Base metals including alloys, all forms value	$144	$556	--	Norway $320; Netherlands $103; West Germany $68.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones value	--	$348	--	Hong Kong $163; Maldive Islands $74.
Cement	237	308	--	All to Maldive Islands.

See footnotes at end of table.

Table 9.—Sri Lanka: Exports and re-exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Clays and clay products including all refractory brick:				
Crude clay ____ kilograms__	329	4,161	401	Netherlands 3,136; West Germany 465.
Products:				
Refractory including nonclay brick ____	(1)	7	(1)	Mainly to Pakistan.
Nonrefractory ____	6,543	11,566	1,330	Singapore 3,275; Hong Kong 3,169.
Fertilizer materials, crude and manufactured ____	471	275	__	All to Japan.
Graphite, natural ____	11,416	11,154	1,745	Japan 4,509; Australia 909; Taiwan 500.
Mica:				
Crude including splittings and waste __	381	555	10	Japan 525; United Kingdom 10; Belgium 10.
Worked including agglomerated splittings ____ kilograms__	__	100	__	All to United Kindgom.
Precious and semiprecious stone:				
Natural ____ carats__	858,324	590,000	19,745	West Germany 144,945; United Kingdom 143,352; Japan 132,992.
Synthetic and reconstructed __do____	__	10,577	10,570	Hong Kong 7.
Salt ____	9,637	210	__	Mainly to Maldive Islands.
Sodium and potassium compounds, n.e.s. kilograms__	__	10	__	Do.
Stone, sand gravel, excluding metal-bearing sand ____	1,091	339	__	Japan 338.
Sulfur:				
Unroasted pyrites ____ kilograms__	__	5	5	
Sulfuric acid, oleum ____do____	__	160	__	All to Maldive Islands.
Other:				
Activated natural minerals____	662	855	370	United Kingdom 284; France 100; Republic of South Africa 43.
Halogens____ kilograms__	380	144	__	All to Maldive Islands.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals____ value__	r$77,724	$53,387	$7,796	West Germany $24,391; Australia $19,265.
MINERAL FUELS AND RELATED MATERIALS				
Coke and semicoke____	__	20	__	All to Japan.
Gas, hydrocarbon____ cubic feet__	r154,598	168,802	__	Maldive Islands 100,162; Pakistan 68,640.
Hydrogen, helium, rare gases kilograms__	159	890	__	All to Maldive Islands.
Petroleum and refinery products:				
Partly refined petroleum 42-gallon barrels__	__	708	__	Do.
Refinery products:				
Nonbunkers:				
Gasoline____do____	3,087	1,608	__	Do.
Distillate fuel oil__do____	(1)	241	__	Mainly to Maldive Islands.
Residual fuel oil __do____	471,292	371,432	__	India 238,555;Australia 132,876.
Lubricants ____do____	(1)	(1)	__	All to United Kingdom.
Other ____do____	97	353	__	All to Maldive Islands.
Bunkers:				
Jet fuel __ thousand 42-gallon barrels__	649	594		
Distillate fuel oil__do____	559	500		
Residual fuel oil __do____	1,862	2,188		
Lubricants ____do____	6	4		
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ____	55,949	81,392	__	Japan 56,211; Taiwan 16,202; Singapore 8,979.

rRevised.
1Less than 1/2.

Table 10.—Sri Lanka: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxide and hydroxide	30	205	(1)	India 143; United Kingdom 44; Japan 16.
Metal including alloys:				
Unwrought	2	18	--	Republic of South Africa 13; Japan 2; Australia 2; United Kingdom 1.
Semimanufactures	3,970	6,698	2	Hong Kong 1,508; Belgium 952; India 794; Japan 767.
Arsenic oxide and acid, kilograms	10	2	--	India 1; United Kingdom 1.
Chromium oxide and hydroxide	6	8	--	United Kingdom 5; West Germany 2.
Copper:				
Matte	--	9	(1)	Mainly from United Kingdom.
Metal including alloys:				
Unwrought	14	52	--	Do.
Semimanufactures	875	8,040	(1)	Japan 6,495; Australia 426.
Gold metal including alloys, unwrought and wrought, troy ounces	r995,868	216,365	--	All from France.
Iron and steel:				
Ore and concentrate	1	118	--	All from Singapore.
Metal:				
Scrap	--	50	--	All from Australia.
Pig iron, cast iron, spiegeleisen, etc	56	122	--	United Kingdom 62; West Germany 60.
Ferroalloys	154	132	--	West Germany 51; North Korea 20; Republic of South Africa 20.
Steel, primary forms	24,756	50,834	--	Republic of South Africa 22,409; Netherlands 16,675; Japan 8,774.
Semimanufactures	70,334	94,008	433	Japan 8,981; Australia 7,951; Republic of South Africa 5,365.
Lead:				
Ore and concentrate	--	1	--	All from France.
Oxide	27	8	--	Mainly from United Kingdom.
Metal including alloys:				
Unwrought	824	500	--	Australia 260; Burma 150; United Kingdom 68.
Semimanufactures	61	79	--	Australia 45; United Kingdom 27.
Magnesium metal including alloys, all forms, kilograms	59	10,901	(1)	United Kingdom 10,001.
Manganese:				
Ore and concentrate	2,101	1,018	--	Singapore 575; Japan 347; United Kingdom 80.
Oxide	235	408	--	Japan 243; United Kingdom 155.
Mercury, 76-pound flasks	476	46	(1)	United Kingdom 41; Singapore 5.
Molybdenum metal including alloys, all forms, kilograms	58	826	--	United Kingdom 671; Sweden 127; Japan 28.
Nickel metal including alloys, all forms	6	15	--	United Kingdom 5.
Platinum-group metals including alloys, unwrought and wrought, troy ounces	180,719	3257	--	All from United Kingdom.
Silver metal including alloys, unwrought and wrought, do	2,122	3,959	--	Do.
Tin metal including alloys:				
Scrap	49	72	--	United Kingdom 70; Japan 2.
Unwrought	4	12	--	Japan 4; Malaysia 3; United Kingdom 2.
Semimanufactures	30	41	(1)	Republic of South Africa 37; United Kingdom 2.
Titanium oxide	76	81	--	United Kingdom 69; West Germany 10; France 1.
Tungsten metal including alloys, all forms, kilograms	300	651	--	Hungary 604.
Uranium and thorium:				
Compounds	4	7	(1)	China, mainland 6.
Depleted metal, kilograms	452	11,133	--	Mainly from Philippines.
Zinc:				
Oxide	925	565	2	United Kingdom 220; Belgium 183; Singapore 64.
Metal including alloys:				
Scrap	1	(1)	--	All from United Kingdom.
Dust (blue powder), kilograms	465	460	48	United Kingdom 312; West Germany 100.
Unwrought	385	551	--	Australia 489; Japan 50; North Korea 10.
Semimanufactures	182	50	(1)	Australia 30; France 10.

See footnotes at end of table.

Table 10.—Sri Lanka: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Other:				
Ores and concentrates	r(1)	2	--	All from Sweden.
Oxides, hydroxides, peroxides	r39	2	(1)	Mainly from West Germany.
Metal:				
Metalloids	4	6	--	Sweden 3; India 2.
Alkali, alkaline earth, rare-earth metals, kilograms	132	4,015	--	West Germay 4,008.
Pyrophoric alloys, ferrocerium, do	79	1	--	All from United Kingdom.
Waste and sweepings of precious metals, value	$161	$91	--	All from Hong Kong.
Base metals including alloys, all forms	4	10	--	West Germany 8; Belgium 1.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	31	38	13	India 17; Singapore 7.
Artificial corundum	1	1	--	Mainly from India.
Grinding and polishing wheels and stones	180	238	1	Japan 135; China, mainland 34.
Dust and powder of precious and semi-precious stones including diamond, carats	3,060	300	100	Japan 200.
Asbestos	1,940	11,780	--	Canada 11,265; Botswana 200; Sweden 50.
Barite and witherite	30	4	--	All from United Kingdom.
Boron materials: Oxide and acid	21	42	15	NA.
Cement	7,228	54,266	--	Singapore 12,249; Philippines 9,000; Sweden 514.
Chalk	213	102	--	United Kingdom 90; India 10.
Clays and clay products including refractory brick:				
Crude clays	r1,507	5,769	1	Netherlands 4,500; Japan 520.
Products:				
Refractory including nonclay brick	3,150	1,449	23	United Kingdom 397; India 126; Thailand 110.
Nonrefractory	11	5,319	(1)	Netherlands 651; India 392.
Diamond:				
Gem, not set or strung, carats	193,888	172,684	--	All from Belgium.
Industrial, value	$13,074	$127	--	Do.
Diatomite and other infusorial earth	3,834	3,271	2	Republic of Korea 3,000; India 248; West Germany 18.
Feldspar and fluorspar,leucite, nepheline	16	370	--	Republic of South Africa 325; United Kingdom 45.
Fertilizer materials:				
Crude	6	9	--	Egypt 5; Netherlands 4.
Manufactured:				
Nitrogenous	83,311	213,723	31,315	Republic of South Africa 30,900; U.S.S.R. 15,510; Iraq 10,700.
Phosphatic	44,530	26,721	--	Egypt 21,741; Netherlands 4,980.
Potassic	20,780	38,529	(1)	Canada 33,529; West Germany 3,000; France 2,000.
Other including mixed	56	11,599	(1)	United Kingdom 5,000; Singapore 69.
Ammonia	157	291	(1)	Indonesia 202; United Kingdom 56.
Graphite:				
Natural, kilograms	--	1	--	All from Italy.
Artificial, do	200	12	--	Japan 10; Switzerland 2.
Gypsum and plaster	988	4,909	--	India 2,980; West Germany 1,413; France 240.
Lime	130	3,361	--	India 1,835.
Magnesite	31	3	--	Mainly from United Kingdom.
Mica:				
Crude including splittings and waste	7	11	--	Mainly from Japan.
Worked including agglomerated splittings, kilograms	303	119	--	Singapore 85; United Kingdom 24.
Pigments, mineral:				
Crude, natural	25	29	--	India 28; United Kingdom 1.
Iron oxide, processed	628	391	--	West Germany 185; United Kingdom 88; India 64.
Precious and semiprecious stones, natural and synthetic, excluding diamond, carats	r102,733	10,015	9,926	France 63; Japan 26.
Pyrite, gross weight	51	--		
Salt	21	5	--	Mainly from Pakistan.

See footnotes at end of table.

Table 10.—Sri Lanka: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Sodium and potassium compounds, n.e.s.:				
Caustic soda	78,446	8,677	--	France 5,150; Romania 2,250; United Kingdom 741.
Caustic potash	43	9	(1)	France 5; West Germany 1.
Soda ash	6,151	5,532	(1)	United Kingdom 2,888; Kenya 2,406.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	78	80	--	India 74; United Kingdom 6.
Worked	24	146	(1)	Hong Kong 124; India 20.
Limestone, other than dimension kilograms	--	60	--	All from India.
Quartz and quartzite do	1	21,720	--	Japan 18,000; West Germany 3,720.
Gravel and crushed rock	29	101	(1)	France 87; India 8; United Kingdom 5.
Sand excluding metal-bearing	13	6	--	United Kingdom 4; India 1.
Sulfur:				
Elemental:				
Other than colloidal	143	520	(1)	Singapore 400; India 45; Belgium 32; United Kingdom 25.
Colloidal	586	317	--	Thailand 140; China, mainland 10; Poland 10.
Sulfur dioxide	(1)	49	--	West Germany 45; India 4.
Sulfuric acid, oleum	612	518	(1)	Singapore 273; Thailand 200; Netherlands 37.
Talc, steatite, soapstone, pyrophyllite	1,310	1,585	(1)	China, mainland 1,152; India 294.
Other:				
Crude	5,563	4,846	--	West Germany 3,250; Japan 26.
Oxides and hydroxides of strontium, magnesium, barium	9	9	2	Japan 6.
Halogens kilograms	144	3,289	(1)	India 2,673; Japan 300.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	24	8,244	1,201	Indonesia 2,246; Singapore 70.
Activated natural mineral products	167	199	7	Japan 168; United Kingdom 24.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2	1	1	
Carbon black and gas carbon	1,898	3,426	1	Romania 1,378; Australia 935; India 647.
Coal, all grades including briquets	484	247	--	Republic of South Africa 102; United Kingdom 95; Thailand 50.
Coke and semicoke	12,391	1,897	--	West Germany 600; United Kingdom 309.
Hydrogen, helium, rare gases	42	22	--	United Kingdom 17.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels	11,142	10,613	--	Saudi Arabia 5,775; Iraq 2,227; Iran 2,162; Libya 449.
Refinery products:				
Gasoline do	33	(1)	--	All from India.
Kerosine and jet fuel do	118	647	--	Singapore 511; China, mainland 57; Aden 55.
Distillate fuel oil do	201	810	--	Singapore 407; China, mainland 300; Aden 90.
Lubricants do	41	24	1	Singapore 9; India 4; Netherlands 4.
Other:				
Mineral jelly and wax do	16	14	(1)	Japan 11; West Germany 2.
Petroleum coke, bitumen, other residues do	(1)	40	--	Mainly from United Kingdom.
Bituminous mixtures do	(1)	2	(1)	Do.
Unspecified do	421	215	(1)	Singapore 214.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	124	64	--	United Kingdom 28; Belgium 25; West Germany 10; France 1.

[r]Revised. NA Not available.
[1]Less than 1/2 unit.
[2]Excludes an unreported quantity valued at $51,841 imported in 1979 from the United Kingdom.
[3]Excludes an unreported quantity valued at $2,002 imported in 1979.

VIETNAM[42]

Vietnam was not a major world producer of any mineral commodity during 1980. It did produce economically significant amounts of coal, phosphate rock, tin, chromite, and cement. Clay, used for brick and roofing tiles, was quarried in large quantity from hundreds of small, local, manually exploited clay pits. The brick and tile were fired generally in primitive batch kilns and used locally. A few large modern kilns provided a higher quality product for more important construction projects. Small amounts of antimony, copper, graphite, iron ore, lead, salt, dimension stone, and zinc were also produced. Deposits of bauxite, manganese, silver, and titanium minerals were also known to exist in the country but were probably not exploited to any important extent.

The Vietnamese recognized the need to survey and prospect for mineral resources that could be useful to the economy. Survey work by Government geologists was underway in 1980 with the help of Bulgaria, Czechoslovakia, Hungary, and the Soviet Union. Bauxite deposits were being delineated in the south. Czechoslovak and Bulgarian specialists were to prospect for lead and zinc in central and southern Vietnam. Selected areas in the south were being mapped with a stress on rare metals potential. Czechoslovak scientists were to help train tin and tungsten prospectors. The sixth geological group, with a work force of 1,100, surveyed limestone and coral deposits for the Ha Tien cement plant, evaluated peat occurrences in Minh Hai Province, fertilizer resources in the Central Highlands, and bauxite in Lam Dong, Dac Lac, and Song Be Provinces. During the bauxite exploration, brown coal, kaolin, and bentonite deposits were also discovered.

Late in 1980, the Permanent Geological Committee of the Council for Mutual Economic Assistance signed an agreement with the Vietnam General Department of Geology to provide technical assistance to Vietnam in geological exploration and research techniques in the 1981-90 period.

Specific data on mineral production are seldom released by the Government, particularly if the figures would show unfavorably on that sector's ability to meet or exceed the planned production. When figures are given, however, they are frequently stated in terms of percent increase over an unstated or unknown period. It was estimated that the mineral sector generally accounted for about 5% of the GNP.

The Vietnamese economy in 1980 continued a downward trend started in 1979. Inept management in both the industrial and agricultural sectors, lack of resources, and inadequate food production, in part caused by natural disasters, were the main causes of the decline. Exacerbating the economic problems was the Government's policy of devoting a major portion of the human and material resources to the military sector. The country had more than 1 million men under arms during 1980, and the Government continued to recruit young men into the armed forces throughout the year. Some sources estimated that nearly one-half of the country's budget was devoted to the armed forces.

With Vietnam experiencing declining production in almost every sector and nominal increases in even the best sectors, the Central Committee was compelled to introduce important reforms in its Sixth Resolution (dated August 1979). These reforms were intended to promote productivity by giving greater freedom to private producers in agriculture and industry, as well as offering a wider scope for the free market in general.[43]

In past years the Government had followed a rigid policy of purchasing grain and other surplus domestic products for a very low price. This resulted in a lack of incentive to produce more than the minimum quota. The policy was changed in early 1980 with a fourfold increase in the purchase price for rice. Even that price was subsequently doubled later in the year.

This rise in the Government's purchasing price for agricultural products, however, brought about a sharp rise in free market prices. The already widespread shortage of consumer goods was also aggravated. Then, in an attempt to slow the inflationary effect of the higher prices, the Government adopted a dual pricing policy. Essential goods would be sold at a stable price, lower than the free market price. Nonessential commodities would be sold at prices paralleling the free market price. The new buying policy would be to offer a stable purchasing price, below the free market price, to cooperatives and individuals for a certain quota of their production. A higher price would be

offered for any production above the quota.

In October 1980, the Government stabilized the grain tax for a period of 5 years at an average of 10% of the volume produced. At the same time the obligatory quota to be sold at the fixed price was also set for 5 years. The results of these new policies would not be clear until well into 1981.

Another reform introduced in some sectors during 1980 was to change the manner in which wages were determined. An end product or piecework wage system was introduced to increase individual incentives and productivity. One of the places where the system was tried was the Ha Tu coal mine. Beginning in the third quarter of 1980, wages were paid on the basis of the end product output. The system reportedly worked well and the Ha Tu Mine was one of the few large enterprises to exceed the 1980 production plan.[44]

Details of production and trade were not available for 1980, but some general information was released in the Vietnamese press. Total industrial output value was Dong 9,490 million[45] in 1980 compared with Dong 9,520 million in 1978 (1979 figures were not included). The Statistics General Department reported that the industrial output index (1975=100) was 123.9 in 1977, 130.6 in 1978, and 124.7 in 1979. The 1980 data were not available, but the index will probably fall between the 1978 and 1979 figures. Coal and cement production showed modest gains in 1980 over the 1978 tonnage.

The 1981 production plan called for increasing electric power output by 6%; coal and phosphorous fertilizer, 10%; cement, 67%; and nitrogen fertilizer, 100%. Chromite and tin production was also to be increased.

Merchandise imports were estimated to be $1,200 million in 1979 with food and raw materials accounting for nearly one-half of the total. Merchandise exports were estimated at $630 million in 1979. Vietnam's main mineral exports have been hard coal and phosphate rock. In view of the prevailing economic problems, it was unlikely that these minerals were exported in the usual quantities in 1980.

In June 1980, Czechoslovakia and Vietnam signed a 5-year trade agreement in which the volume of mutual trade was to be doubled over that of the previous 5-year period. Total imports from Czechoslovakia in 1979 were about $46 million, while exports from Vietnam were about $13 million. Vietnam will receive, among other items, power and engineering equipment and machinery and will export rubber, coffee, clothing, and raw materials, including tin.

Aid from Japan, an important source of raw materials and spare parts, was frozen for the second year. The country was thus heavily dependent on imports of raw materials from the Soviet Union. The Vietnamese press, in July 1980, indicated that 50% of Vietnam's exports went to the U.S.S.R., which had supplied the bulk of raw materials, fuel, technical equipment, food, and consumer goods. In 1980, Moscow was believed to have given credit worth $1 billion to Vietnam. One of the major goals of the third 5-year plan (1980-85) was to increase the value of exports, in particular tropical farm products, minerals, and handicrafts, in order to pay for this large inflow of imports.

COMMODITY REVIEW

Metals.—*Tin.*—The Son Duong (possibly 21°40'N, 105°28'E) tin mine was striving to improve production and succeeded in increasing the ore extraction rate by 3% and overfulfilled the 1980 norm by 10 tons. In past years the mine at Cao Bang supplied the majority of the country's tin concentrate to the small smelter at Tinh Tuc. It is not certain if Son Duong represents a new mine or an older operation not previously mentioned in the Vietnamese press. In either case, if Cao Bang is still operational, the tin production could be substantially higher than the reported tonnage.

Nonmetals.—*Brick.*—Two new brick factories began operating during 1980. The Phuc Thinh kiln was inaugurated on December 30, 1979, and began producing at a rate of 25 million bricks per year. The plant was built with Bulgaria's technical and financial assistance and was located in a northern suburb of Hanoi.

The Linh Nam silicate brick factory was dedicated on July 20, 1980, and began operating at a design rate of 30 million bricks per year. The plant was built with technical and financial aid from Poland. The two plants will require a combined total of over 140,000 tons per year of raw materials, clay, silica sand, and limestone.

Cement.—Work on expanding the production capacity of the cement industry continued at a relatively rapid pace. Three major rotary kiln plants were under construction during 1980.

The Bim Son cement mill was nearing completion at yearend 1980 with financial

and technical assistance from the Soviet Union. The plant was located at Bim Son (20°05'N, 105°52'E) in Thanh Hoa Province.[46] Construction progress on the first of two 600,000-ton-per-year kilns was apparently unsatisfactory in 1979 and early 1980. Additional specialized construction groups were brought in and around-the-clock work accelerated progress. The first kiln was then rescheduled for firing by April 20, 1981, and the entire plant was to be completed by the end of 1981. The maximum effort being put into completing the first production line may have disrupted a balanced construction effort on the second production line. As a result, the scheduled yearend completion of the whole plant may be unrealistic.

Construction on the Danish- and Japanese-aided 3,100-ton-per-day Hoang Thach plant was also running behind schedule, and every effort was made to increase the efficiency and speed of construction and to hasten assembly of the imported equipment. The plant was rescheduled for firing by June 1981, and the entire plant was to be completed by yearend 1981.

Equipment for the French-aided Ha Tien cement plant expansion was originally ordered in 1977 but was just being delivered and transported to the construction site during 1980. Site preparation was continuing in late 1980 and installation of equipment was to begin in the first quarter of 1981.

The plant will have a pre-calcining system rated at 3,000 tons per day with a 4.8- by 89.5-meter kiln with planetary coolers, one 4,500-horsepower air-swept raw mill, 5.2 by 11.0 meters, rated for 240 tons per hour, and two 4,200-horsepower cement mills, each 4.2 by 14.0 meters, rated for 90 tons per hour.

Despite the fact that none of the big new rotary kiln plants was completed during 1980, cement production was increased substantially during the year. No mention was made in the press of the Haiphong cement plant successfully overcoming raw material supply problems and fulfilling the 1980 production goal of 500,000 tons. In light of general industry problems in other sectors, extensive press coverage almost certainly would have been made if the plant had met or exceeded its target. The production increase was probably a tangible result of the completion of a number of mini-cement plants during 1979 and 1980. Many of these small vertical shaft kiln plants with capacities between 5,000 and 20,000 tons per year are now operating and supply a satisfactory product for local construction projects. Completion of the big rotary kiln plants will relieve the still persistent shortages of cement and allow more rapid progress on construction projects throughout the country.

Fertilizer.—Lam Thao superphosphate plant, the country's largest, was being expanded during 1980 with Soviet technical assistance and a local labor force of over 750 persons. The expansion was scheduled for completion in the first quarter of 1982.

During 1980, the Lao Cai apatite mining region's administration was occupied with repairing damaged equipment and reorganizing the management of the mines. In particular, the system of paying wages on the basis of the product obtained was instituted here as in other areas of the country. Apparently the system has led to an increase in production but figures suitable for comparison with past production were not available. Although production probably increased over 1979 levels, it was very unlikely that it surpassed the preborder-war output.

At least one 4.6-cubic-meter capacity power shovel, 1 bulldozer, and 20 heavy trucks were returned to service during the first half of 1980.

One event occurred in 1980 that could help remove a transportation bottleneck in fertilizer distribution. Hanoi radio claimed that the Hanoi-Lao Cai Railroad had been completed and a rail line installed on the Duong Bridge. Lao Cai had been believed to be served by an old low-capacity, narrow-gage railroad system. It is possible that the broadcast referred to the completion of a standard gage line to serve the vital apatite mines. Opening a standard gage line would greatly increase the tonnage of raw ore that could be shipped to the numerous phosphate grinding plants around the country.

Graphite.—In early 1980 the Ministry of Engineering and Metals and workers of Hoang Lien Son Province inaugurated the Mau-a (21°53'N, 104°41'E) graphite mine and concentration plant, the first such facility in Vietnam. The local ore contained 18% to 20% carbon and was beneficiated by crushing and flotation to an 80% carbon concentrate. The plant was designed for a capacity of 1,500 tons of concentrate per year. Late in 1980, Hanoi radio claimed that the Provincial authorities had "expanded the graphite mine" and had "since early this year...exploited 3,000 tons of graphite."[47]

Mineral Fuels.—*Coal.*—The coal sector continued to have trouble meeting production goals during 1980. The original 5-year plan target of 10 million tons of washed coal proved to be wildly optimistic and was revised sharply downward. At the beginning of 1980, the year's goal was set at 8.5 million tons and at 10.0 million tons "within the next few years."[48] By May, Hanoi radio was describing the measures to be used to turn out 6.3 million tons in 1980.[49] By yearend 1980, it was apparent that even this goal was not reached.

The Hon Gai-Cam Pha mining area was the major producer of high-quality hard coal. In past years, the area produced enough for all domestic need plus a considerable surplus. The exported surplus provided one of Vietnam's major sources of foreign exchange earnings.

There were a number of articles in the Vietnamese press during the year criticizing progress in the coal sector and trying to determine how to increase production.

One of the biggest problems was all phases of the coal transport network, from the working face to the ultimate consumer. Although an adequate number of trucks were at hand, a high proportion were not operable for lack of proper maintenance and spare parts. Roads were often in such poor shape that trucks were forced to travel at a very low speed. Under these conditions, drive train and tire wear were excessive, further overloading the already inadequate repair facilities. Railroad track was in equally bad condition; rail was badly worn and ties not replaced. A high proportion of coal cars were not operable.

In addition to equipment problems, there were also problems of poor health and nutrition among the miners, particularly those working in the underground mines. The most skilled and experienced workers were the ones leaving, and the new younger workers did not have the technical training or experience to maintain desired production levels or perform required maintenance or repairs on the sophisticated mining equipment.

With the pullout of the experienced Chinese managers and cadre in 1978, much of the job of planning, designing, and development work reverted to Vietnamese cadre. They had the enthusiasm but not the technical or management skills required to keep the complex mining operations running smoothly.

The Government was doing everything in its power to boost production and efficiency in the mines. The incentive pay system, described earlier, was tried in at least some of the pits with apparently good results. In addition, several large new mines were under construction and many operating mines were being expanded or reequipped.

Development of the Cao Son Mine in Quang Ninh Province began in 1977 and has received a good deal of attention in the press. The mine will be a 3-million-ton-per-year operation when fully developed. Built with technical and monetary aid from the Soviets, the mine will be one of the showpieces of the Vietnamese mining industry. Several million cubic meters of overburden had already been removed by the beginning of 1980, and production was to start in May. The pit was to produce a limited tonnage during the startup period then produce about 1 million tons the first full year of operation. Development will continue until the design output of 3 million tons per year is reached.

Another showpiece Soviet-aided project was to be the Mong Duong Mine, reportedly the first vertical shaft coal mine in the country (presumably other underground workings have horizontal or inclined adits). The mine was scheduled for an August 1981 startup at a production of 430,000 tons per year. Development work was to include 17,000 meters of underground crosscuts. By May 1980, 70% of underground work and 80% of aboveground installations had been completed.

Other projects utilizing Soviet aid were the reconstruction of Vang Danh Mine and sorting plant, restoration of Mong Duong sorting plant, design and construction of Ha Tu, Coc Sau, and Deo Nai Mines, and tripling capacity of Uong Bi coal selection plant to 1.8 million tons per year. The Khe Tam Mine with design capacity of 1.8 million tons per year will be built during the third 5-year plan.

An unnamed coal sorting plant built with Polish assistance was inaugurated near Cua Ong Harbor in Quang Ninh Province on July 20, 1980. The plant capacity was designed to reach 3.2 million tons per year.

Petroleum.—The three companies which have been operating offshore, AGIP S.p.A. of Italy, Bow Valley Industries Ltd. of Canada, and Deminex Deutsche Erdoelversorgungsgesellschaft of the Federal Republic of Germany, all met their 1979 and

1980 exploration obligations. The results were a very disappointing succession of 12 dry holes. Bow Valley's contract still called for it to drill two more holes by yearend 1982. There were no U.S.-owned companies operating offshore of Vietnam.

In July 1980, the U.S.S.R. signed an agreement with Vietnam for cooperation in geological prospecting and extraction of oil and gas. The agreement was said to cover the Bach Ho structure where Mobil Oil Corp. (United States) drilled a well that tested 2,400 barrels per day in February 1975.[50]

There was considerable speculation as to the Soviet's technical ability to drill in the open ocean conditions off southern Vietnam. However, they have been operating a Japanese-built jackup rig off Sakhalin Island, which could be brought to Vietnamese waters. Soviet equipment in European waters would take several months to transfer to Vietnam but could be used.

It was confirmed in 1979 by Vietnamese officials that natural gas had been discovered outside of Hanoi. The discovery apparently has not been developed, and it was speculated that the gas was contaminated and would be difficult to handle.

Vietnam produced no oil or natural gas in 1980 and imported petroleum products to fill its needs.

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[1]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[2]Where necessary, values have been converted at the rate of 15.0 takas=U.S.$1.00.
[3]The Bangladesh fiscal year runs from July 1 through June 30. All FY 1980 figures are provisional.
[4]U.S. Department of Commerce. Foreign Economic Trends and Their Implications for the United States. Bangladesh - March 1981, FET 81-028.
[5]Government of the People's Republic of Bangladesh, Dacca. Ministry of Planning, Bureau of Statistics, Statistics Division, Monthly Statistical Bulletin of Bangladesh. December 1980, p. 215.
[6]The Bangladesh Observer, Dacca. Dec. 30, 1980, p. 1.
[7]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[8]Standard Chartered Review. February 1981, p. 26.
[9]Far Eastern Economic Review, Ltd. (Hong Kong). Asia 1981 Yearbook. 1981, p. 112.
[10]Petroleum News. V. 2, No. 10, January 1981, pp. 8, 11.
[11]Work cited in footnote 4.
[12]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[13]Where necessary, values have been converted from Australian dollars ($A) to U.S. dollars at the rate of $A0.8890=U.S.$1.00.
[14]By Edmond Chin, physical scientist, Branch of Foreign Data.
[15]Hong Kong 1981. D. R. Rick (Government Printer). Hong Kong, 1981, 307 pp.
[16]South China Morning Post. Hong Kong. Jan. 17, 1980, p. 7.
[17]Hong Kong (Foreign Economic Trends). U.S. Department of State, December 1980, 9 pp.
[18]Monthly Digest of Statistics, Census and Statistics Department. Hong Kong, February 1981, 84 pp.
[19]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[20]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[21]Asian Wall Street Journal, v. 5, No. 59, Nov. 21, 1980, pp. 1, 6.
[22]Work cited in footnote 21.
[23]Vientiane, KPL (radio broadcast) in English, 0918 GMT, July 23, 1980.
[24]Metal Bulletin, No. 6478, Apr. 1, 1980, p. 42.
[25]By Edmond Chin, physical scientist, Branch of Foreign Data.
[26]Montsame. Ulaanbaatar, July 18, 1980.
[27]Montsame. Ulaanbaatar, Aug. 5, 1980.
[28]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[29]Where necessary, values have been converted from Nepal rupees (NRs) to U.S. dollars at the rate of NRs12.0=U.S.$1.00.
[30]Far Eastern Economic Review (Hong Kong). Asia 1981 Yearbook. P. 207.
[31]By Edmond Chin, physical scientist, Branch of Foreign Data.
[32]Singapore (Foreign Economic Trends). U.S. Department of State, July 1980, 13 pp.
[33]Monthly Digest of Statistics. Department of Statistics, Singapore, v. 20, No. 3, March 1981, 137 pp.
[34]Metals Week, v. 50, No. 7, Feb. 12, 1979, p. 5.
[35]U.S. Department of State, Singapore. Airgram A-20, Apr. 15, 1981, 16 pp.
[36]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[37]Because of fluctuating exchange rates, a meaningful conversion to U.S. currency is impractical. The average exchange rates for Sri Lanka rupees (Rs) were as follows for US$1.00: 1977=Rs9.15, 1978=Rs15.61, 1979=Rs15.57, and 1980=Rs15.5 to Rs16.3 through midyear.
[38]Far Eastern Economic Review Ltd. (Hong Kong). Asia 1981 Yearbook. 1981, p. 246.
[39]Asian Wall Street Journal, v. 4, No. 211, June 28, 1980, p. 2.
[40]Colombo International Service in English (radio broadcast) 1045 GMT, Apr. 10, 1981.
[41]U.S. Embassy, Colombo, Sri Lanka. State Department Airgram A-14, Mar. 27, 1981, p. 8.
[42]By Gordon L. Kinney, physical scientist, Branch of Foreign Data.
[43]Far Eastern Economic Review (Hong Kong). V. 3, No. 3, Jan. 9, 1981, pp. 40-41.
[44]Nhan Dan (Hanoi) in Vietnamese. Jan. 29, 1981, p. 2, (Article by Hong Khanh).
[45]Meaningful conversion rate not available.
[46]The plant has been referred to in the press by several names, including Binh son, Dien Son, Dinh son, and Bien Son. The most recent Vietnamese sources appear to have settled on Bim Son.
[47]Hanoi Domestic Service in Vietnamese (radio broadcast) 0400 GMT, Nov. 14, 1980.
[48]Hanoi Domestic Service in Vietnamese (radio broadcast) 1100 GMT, Sept. 17, 1980.
[49]Hanoi VNA in English (radio broadcast) 1606 GMT, May 23, 1980.
[50]Petroleum News (Southeast Asia). V. 2, No. 10, January 1981, p. 59.

Table 11.—Vietnam: Apparent exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal destinations, 1979
METALS			
Antimony metal including alloys, all forms	--	59	All to Japan.
Chromium and chromite	--	13,516	Do.
Tin metal including alloys:			
Unwrought	87	80	Hong Kong 50; Japan 22.
Semimanufactures	--	1	All to Hong Kong.
NONMETALS			
Salt	9,661	2,020	Do.
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite and bituminous	r489,255	588,994	Japan 319,061; Republic of Korea 249,472.
Briquets of coal	--	7,695	All to Thailand.
Petroleum refinery products:			
Kerosine, 42-gallon barrels	318	1,225	All to Hungary.
Lubricants, do.	--	1,239	All to Saudi Arabia.

rRevised.

[1]Owing to a lack of official trade data published by Vietnam, this table should not be taken as a complete presentation of Vietnam's mineral export. These data have been compiled from various sources, which include United Nations information and data published by the partner trade countries. Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

Table 12.—Vietnam: Apparent imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS			
Aluminum metal including alloys:			
Unwrought	999	--	
Semimanufactures	1,511	786	Hungary 606; Japan 147; Sweden 24.
Chromium oxide and hydroxide	--	10	All from Japan.
Cobalt oxide and hydroxide	--	4	Do.
Copper:			
Sulfate	--	30	All from Bulgaria.
Metal including alloys, semimanufactures	218	73	Japan 55; Australia 8; Sweden 6.
Iron and steel metal:			
Pig iron	16,300	3,200	All from Japan.
Ferroalloys	e900	NA	NA.
Semimanufactures:			
Bars, rods, angles, shapes, sections	2162,674	38,786	Japan 15,841; Poland 12,508; Sweden 4,599.
Universals, plates, sheets	106,140	21,960	Japan 13,505; Hungary 2,858; Sweden 2,227.
Hoop and strip	2,122	1,444	West Germany 990; France 233; Japan 219.
Rails and accessories	4	206	France 160; Sweden 39.
Wire	15,157	3,842	Japan 2,981; Sweden 858.
Tubes, pipes, fittings	212,038	4,814	Japan 3,406; West Germany 468; Singapore 432.
Castings and forgings, rough	1,457	1,004	France 752; Japan 251.
Lead:			
Oxide	--	5	All from Japan.
Metal including alloys:			
Unwrought	1	--	
Semimanufactures	51	--	
Manganese oxide	501	200	All from Japan.
Mercury, 76-pound flasks	--	30	Do.
Nickel metal including alloys, semimanufactures	--	32	Sweden 19; Italy 13.
Silver metal including alloys, unwrought and wrought, value, thousands	$25	--	
Tin metal including alloys, semimanufactures	2	--	
Titanium oxide	100	(3)	All from Japan.
Tungsten metal including alloys, all forms, kilograms	r1,000	181	Do.
Zinc:			
Oxide and peroxide	--	2	All from Singapore.
Metal including alloys, semimanufactures	67	--	

See footnotes at end of table.

Table 12.—Vietnam: Apparent imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Principal sources, 1979
METALS —Continued			
Other:			
Ores and concentrates	200	--	
Oxides, hydroxides, peroxides	94	62	All from Japan.
Metalloids	54	--	
NONMETALS			
Abrasives, n.e.s.:			
Natural: Pumice, emery, corundum, etc	--	150	All from Japan.
Grinding and polishing wheels and stones	1	3	Sweden 2.
Barite and witherite	--	1,170	All from Singapore.
Cement	r241,789	77,913	U.S.S.R. 49,000; Singapore 18,628; Japan 6,476.
Clays and clay products:			
Crude:			
Bentonite	--	717	All from Singapore.
Other	2	190	Japan 188.
Clay products:			
Refractory	503	9,220	Japan 5,410; France 2,447; Hungary 1,163.
Nonrefractory	74	882	Italy 702; Sweden 119.
Diatomite and other infusorial earth	60	50	All from Japan.
Feldspar and fluorspar	302	4	All from Singapore.
Fertilizer materials:			
Manufactured:			
Nitrogenous	175,729	209,958	U.S.S.R. 172,552; Bulgaria 20,405.
Potassic	15,984	44,683	U.S.S.R. 44,682.
Other including mixed	31	--	
Ammonia	4	3	Japan 2.
Gypsum and plasters	4,100	50	Singapore 34; France 16.
Lime	--	9	Austria 7.
Mica:			
Crude including splittings and waste	--	5	All from Singapore.
Worked	5	2	All from Japan.
Pigment, mineral: Iron oxides, processed	1	14	Japan 10.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	[2]7,395	86	West Germany 75.
Caustic potash	30	--	
Soda ash	e5,000	8	Singapore 7.
Stone, sand and gravel:			
Dimension stone, worked	1	--	
Quartz and quartzite	2	--	
Sand excluding metal-bearing	243	750	All from Sweden.
Sulfur:			
Elemental, colloidal	1	--	
Sulfuric acid	--	1	All from Japan.
Talc	430	50	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	360	Singapore 350.
Carbon black	1,253	350	All from Japan.
Coal, anthracite and bituminous	--	61,993	All from Australia.
Coke and semicoke	27,873	5,000	All from Japan.
Petroleum refinery products:			
Gasoline -- thousand 42-gallon barrels	751	1,056	Algeria 716; Italy 340.
Kerosine -- do	44	175	Algeria 122; Italy 53.
Distillate fuel oil -- do	753	734	Italy 627; Algeria 107.
Residual fuel oil -- do	1,492	270	All from Singapore.
Lubricants -- do	313	865	Singapore 694; Italy 136.
Other:			
Liquefied petroleum gas -- do	--	11	Japan 11.
Mineral jelly and wax -- do	3	15	Italy 10; Japan 5.
Nonlubricating oils -- do	--	([3])	All from Japan.
Petroleum coke -- do	--	4	All from Singapore.
Bitumen and other residues -- do	58	111	Do.
Bituminous mixtures -- do	--	1	Do.
Unspecified, crude petroleum and refinery products -- do	e4,100	NA	NA.
Mineral tar and oil-, petroleum-, or gas-derived crude chemicals	4,712	5,491	All from Japan.

eEstimated. rRevised. NA Not available.

[1]Owing to a lack of official trade data published by Vietnam, this table should not be taken as a complete presentation of Vietnam's mineral imports. These data have been compiled from various sources, which include United Nations information and data published by the partner trade countries. Unless otherwise specified, data are compiled from official trade statistics of individual trading partners.

[2]The total includes estimated exports from the U.S.S.R. which have been omitted for 1979.

[3]Less than 1/2 unit.

The Mineral Industry of Other Countries of the Near East

By E. Shekarchi[1] and Peter J. Clarke[2]

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AFGHANISTAN

A year after the Soviet Union invaded Afghanistan and replaced President Amin with their choice, President Karmal, Afghanistan remained in turmoil. In some respects, the political and economic situation in Afghanistan was no better by the end of 1980 than it was preceding the December 1979 invasion. The Government faced widespread and growing alienation and resistance, virulent factionalism within the ruling party, and an acute shortage of material. The mining sector of the country did not fare better either; the only raw material produced in a significant amount was natural gas, which was exported mainly to the Soviet Union. No statistics on production of other minerals and materials were available by yearend.

Most of Afghanistan's gas production was from the Hodja-Gugerdag Field, southeast of Shibarghan. The gas flow from this field had been about 300 million cubic feet per day since 1961. An estimated 230 to 250 million cubic feet per day of Hodja-Gugerdag's production was moved by pipeline across the Amu-Darya River into the Soviet Union. Most of the remainder was transmitted eastward to a 105,000-ton-per-year fertilizer plant and an electric power station built near Mazar-i-Sharif with Soviet assistance. After the Soviet invasion, the second gasfield, Djar-Kuduk, in the Shibarghan area, was brought under production. This field, which will produce about 200 million cubic feet per day, consists of four gas zones in the Jurassic and lower Cretaceous zones between 3,000 and 8,500 feet deep. The gas has a high hydrogen sulfide content, with considerable carbon dioxide. A new treatment plant was built at Djar-Kuduk by Soviet technicians under a turnkey contract at the end of 1980. It is believed that most of the Djar-Kuduk's initial flow will be sent to the Soviet Union.

Table 1.—Other countries of the Near East: Production of mineral commodities[1]

Country, commodity, and unit of measure	1976	1977	1978	1979	1980[p]
AFGHANISTAN[2]					
Asbestos—metric tons	13,260	13,000	e13,000	4,000	--
Barite—do	5,316	12,100	12,930	3,000	--
Cement, hydraulic—do	e167,000	136,000	127,000	140,000	e50,000
Coal, bituminous—do	164,131	182,000	212,725	100,000	--
Gas, natural:					
Gross—million cubic feet	96,000	90,000	90,000	70,000	e70,000
Marketed—do	89,805	e84,000	81,824	60,000	e60,000
Gem stone: Lapis Lazuli—kilograms	7,406	6,310	1,984	6,000	--
Gypsum—metric tons	NA	NA	6,648	--	--
Natural gas liquids—thousand 42-gallon barrels	9	e10	e10	10	e5
Nitrogen: N content of ammonia[e]—metric tons	35,000	35,000	25,000	25,000	e10,000
Salt, rock—do	69,583	77,684	81,112	20,000	e5,000
Talc—do	8,685	5,711	1,775	500	--
BAHRAIN					
Aluminum metal:					
Primary, smelter—metric tons	122,058	121,356	122,800	126,000	126,152
Gas, natural:					
Gross—millions cubic feet	107,464	121,228	131,150	143,449	e140,000
Marketed—do	76,931	83,392	91,805	102,950	97,468
Natural gas liquids:					
Butane and propane—thousand 42-gallong barrels	NA	NA	NA	485	e1,500
Natural gasoline—do	NA	NA	NA	NA	e1,200
Petroleum:					
Crude—thousand 42-gallon barrels	21,287	21,236	20,190	18,741	18,338
Refinery products:					
Gasoline—do	9,520	9,829	11,099	9,249	8,869
Jet fuel—do	8,833	11,743	11,756	11,803	13,797
Kerosine—do	5,361	3,265	912	868	547
Distillate fuel oil—do	19,475	23,571	23,988	23,574	20,586
Residual fuel oil—do	26,476	33,687	29,373	30,640	27,046
Lubricants—do	--	344	379	130	375
Other—do	9,084	10,523	10,939	13,201	e12,300
Refinery fuel and losses—do	1,257	2,271	1,507	2,245	e2,100
Total—do	80,006	95,233	89,953	91,710	e85,620
Sulfur, byproduct of petroleum—metric tons	10,000	7,000	25,909	25,148	32,559
JORDAN					
Cement, hydraulic—thousand metric tons	533	566	564	800	800
Clays—do	12	6	9	25	30
Gypsum—do	21	22	36	36	70
Iron and steel: Crude steel—do	r42	r42	60	90	90
Lime—metric tons	3,000	3,000	3,000	3,500	e3,500
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	1,729	1,954	2,108	2,465	2,263
Jet fuel—do	834	872	1,152	1,104	1,759
Kerosine—do	1,241	829	1,146	1,062	1,314
Distillate fuel oil—do	2,505	2,604	3,109	3,499	3,509
Residual fuel oil—do	1,601	1,558	1,937	2,584	3,312
Other:					
Liquefied petroleum gas—do	428	394	500	r e565	475
Asphalt—do	385	497	643	r e730	581
Unspecified including lubricants—do	4	--	49	r e55	e50
Refinery fuel and losses—do	516	559	559	r e635	e637
Total—do	9,243	9,267	11,203	12,699	e13,900
Phosphate rock—thousand metric tons	1,717	1,782	2,303	2,825	4,243
Salt—do	20	30	30	30	
Stone:					
Limestone—do	5,000	5,000	6,000	e6,000	4,182
Marble—thousand square meters	150	(3)	160	200	200
LEBANON[2]					
Cement, hydraulic—thousand metric tons	e1,704	1,360	1,381	2,122	e2,200
Gypsum—metric tons	e13,000	15,000	11,000	9,750	10,000
Iron and steel:					
Crude steel—thousand metric tons	8	7	6	--	--
Semimanufactures—do	--	--	250	220	e220
Lime[e]—do	180	162	101	120	120
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	e3,904	2,809	4,019	3,498	e3,400
Jet fuel—do	e1,097	964	1,019	923	e900
Kerosine—do	e190	206	144	175	e150
Distillate fuel oil—do	e3,101	2,432	2,354	2,609	e2,600
Residual fuel oil—do	e4,650	4,595	4,367	5,237	e5,000

See footnotes at end of table.

Table 1.—Other countries of the Near East: Production of mineral commodities[1] —Continued

Country, commodity, and unit of measure	1976	1977	1978	1979	1980[p]
LEBANON[2] —Continued					
Petroleum refinery products —Continued					
Other:					
Liquefied petroleum gas ---- do ----	[e]775	531	--	361	[e]300
Unspecified ---- do ----	--	--	151	212	[e]200
Refinery fuel and losses ---- do ----	[e]906	1,011	724	887	[e]800
Total ---- do ----	[e]14,623	12,548	12,778	13,902	[e]13,350
Salt[e] ---- thousand metric tons ----	35	35	12	10	[e]12
OMAN					
Gas, natural:					
Gross ---- million cubic feet ----	137,323	139,868	[r e]130,000	[r e]122,000	[e]117,000
Marketed ---- do ----	3,806	4,745	[e]5,500	17,657	21,189
Natural gas liquids thousand 42-gallon barrels ----	--	--	500	1,275	[e]1,500
Petroleum, crude ---- do ----	133,795	123,626	114,975	107,845	103,528
Sand ---- metric tons ----	NA	NA	NA	NA	101,678
Stone, not further described ---- do ----	NA	NA	NA	NA	329,748
PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN					
Petroleum refinery products:					
Gasoline ---- thousand 42-gallon barrels ----	845	[e]1,440	850	[e]1,000	[e]1,000
Jet fuel ---- do ----	1,169	[e]1,171	1,280	1,200	[e]1,200
Kerosine ---- do ----	779	[e]1,085	775	[e]800	[e]800
Distillate fuel oil ---- do ----	2,808	[e]2,922	[e]2,000	[e]2,500	[e]2,500
Residual fuel oil ---- do ----	6,019	[e]6,114	[e]6,000	[e]6,000	[e]6,000
Other ---- do ----	765	[e]860	[e]700	[e]800	[e]800
Refinery fuel and losses ---- do ----	772	[e]802	[e]869	[e]870	[e]870
Total ---- do ----	13,157	[e]14,394	12,474	13,170	[e]13,170
Salt[e] ---- thousand metric tons ----	75	75	75	75	[e]80
QATAR[2]					
Cement, hydraulic ---- do ----	172	[e]170	208	[2]237	209
Iron and steel semimanufactures ---- do ----	--	--	86	350	450
Gas, natural:					
Gross ---- million cubic feet ----	167,038	151,499	164,212	235,795	[e]220,000
Marketed[3] ---- do ----	52,124	56,750	52,230	154,041	[e]146,500
Natural gas liquids thousand 42-gallon barrels ----	--	--	--	77	[e]265
Nitrogen: N content of ammonia -- metric tons ----	[e]90,000	105,000	166,000	303,400	418,000
Petroleum:					
Crude ---- thousand 42-gallon barrels ----	181,644	162,316	176,537	184,772	172,554
Refinery products:					
Gasoline ---- do ----	671	764	796	921	[e]950
Jet fuel ---- do ----	382	449	455	512	[e]500
Kerosine ---- do ----	39	36	38	31	[e]50
Distillate fuel oil ---- do ----	840	927	908	939	[e]1,000
Other ---- do ----	46	61	72	[e]75	[e]75
Refinery fuel and losses and partly finished oil ---- do ----	30	362	1,439	[e]1,500	[e]1,500
Total ---- do ----	2,008	2,599	3,708	3,978	4,075
Stone: Limestone ---- thousand metric tons ----	[e]2,000	[e]2,500	3,103	3,000	2,036
SYRIA					
Asphalt, natural ---- do ----	125	99	35	83	[e]100
Cement, hydraulic ---- do ----	1,110	1,395	1,433	1,847	[e]1,950
Gas, natural:					
Gross[e] ---- million cubic feet ----	61,000	69,400	56,500	60,000	[e]60,000
Marketed ---- do ----	7,800	[e]9,000	[e]7,500	7,500	[e]7,000
Gypsum ---- metric tons ----	62,496	85,643	[e]86,000	63,500	[e]65,000
Iron and steel: Crude steel thousand metric tons ----	80	115	120	90	[e]100
Nitrogen: N content of ammonia -- metric tons ----	[e]23,000	23,000	19,000	75,888	[e]77,000
Petroleum:					
Crude ---- thousand 42-gallon barrels ----	69,685	63,620	62,500	68,709	[e]65,000
Refinery products:					
Gasoline ---- do ----	3,434	4,599	4,675	4,745	[e]5,000
Kerosine and jet fuel ---- do ----	2,920	2,993	3,023	2,920	[e]3,500
Distillate fuel oil ---- do ----	5,282	8,067	8,355	6,935	[e]8,500
Residual fuel oil ---- do ----	7,273	9,125	8,924	10,585	[e]10,000
Other:					
Liquefied petroleum gas ---- do ----	244	365	464	1,825	[e]500
Asphalt ---- do ----	673	1,022	1,889		[e]1,400

See footnotes at end of table.

Table 1.—Other countries of the Near East: Production of mineral commodities[1] —Continued

Country, commodity, and unit of measure	1976	1977	1978	1979	1980[p]
SYRIA —Continued					
Petroleum —Continued					
Refinery products —Continued					
Other —Continued					
Refinery fuel and losses ____ do ____	1,288	1,570	--	730	[e]1,500
Total ____ do ____	21,114	27,741	27,330	27,740	[e]30,400
Phosphate rock ____ thousand metric tons ____	511	425	[e]750	1,272	1,250
Salt ____ do ____	54	106	[e]110	75	96
Stone, sand and gravel:					
Stone:					
Dimension: Marble ____ cubic meters ____	NA	57,063	[e]50,000	71,562	[e]70,000
Other ____ thousand cubic meters ____	NA	985	[e]1,000	2,013	[e]2,000
Sand and gravel ____ do ____	NA	4,567	[e]5,000	7,870	[e]7,500
Sulfur, byproduct of petroleum and natural gas thousand metric tons ____	5	[e]4	[e]6	[e]6	[e]5
YEMEN ARAB REPUBLIC[2]					
Cement ____ do ____	[e]60	60	63	90	81
Salt[e] ____ do ____	100	75	30	90	65

[e]Estimated. [p]Preliminary. NA Not available.

[1]Table includes data available through Oct. 12, 1981.

[2]In addition to the commodities listed, a variety of other crude construction materials (common clays, stone, and sand and gravel) presumably is produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[3]Includes gas reinjected into reservoirs, if any.

BAHRAIN

Despite the continuing decline in Bahrain's production of crude oil, revenues from the petroleum sector were at an all-time high in 1980. Bahrain's gross domestic product (GDP) in 1980 was estimated at $2.2 billion[3] in constant 1977 dollars, which represents a real growth rate of 5.4% over the 1979 GDP. Following the Government's successful deflationary policies in 1978-79, planned increases in capital expenditure in the 1980-82 development plan were intended to sustain real growth in the economy at 7% to 8% per year. The rate of inflation was lowered from a high of about 20% in 1977 to 8% in 1980, which gave further stimulus to the Government to increase spending.

Revenues from the petroleum sector amounted to about $3.15 billion, which represents a substantial 33% increase over the 1979 level. Bahrain's only oilfield, the Awali Field located onshore, produced about 47,000 barrels per day. The field has been in operation for nearly 50 years, and requires constant maintenance and the use of highly sophisticated secondary and tertiary recovery techniques to remain productive. These techniques have extended the life of the field for an additional 10 to 12 years, to the late 1990's or possibly beyond the year 2000; original estimates predicted exhaustion of reserves by 1990.

The major source of Bahrain's oil income is the Abu Sa'fah Field, located in the Persian Gulf north of the island. The field is owned and operated by Saudi Arabia, but the revenues from production are split evenly by Saudi Arabia and Bahrain. Abu Sa'fah produced about 150,000 barrels per day in 1980, and consequently over half of Bahrain revenues from crude oil are from this arrangement. Crude oil from the Awali Field, as well as crude oil from Abu Sa'fah, was sold at official Saudi Arabian prices.

Bahrain produced approximately 85 million barrels of refined petroleum products in 1980 from the Sitra oil refinery. Input for the refinery came from Bahrain's own field, with the remainder being imported from Saudi Arabia. Petromin, the Saudi Arabian Petroleum and Minerals Organization, was under contract to supply the refinery with 100,000 barrels per day of crude oil. Another 100,000 barrels per day was supplied by the California Texas Petroleum Co. (Caltex), a joint venture of Chevron U.S.A. Inc. and Texaco Inc. (United States), which operate the refinery. Caltex's input is derived from their crude oil entitlements in Saudi Arabia.

Caltex originally owned the entire oil industry in the country (both the oilfield assets and the Sitra refinery), through its subsidiary company, the Bahrain Petroleum Co. (Bapco). The gradual transfer of ownership of the oilfield assets was completed in 1979. The Bahrain National Oil Co. (Banoco), a Government-owned company, became the new owner. In July 1980, an agreement was signed transferring 60% ownership of the 250,000-barrel-per-day re-

finery to the Government. The remaining 40% share remained in the hands of Caltex. Bapco continued to operate the refinery, receiving crude from both shareholders and processing it on their behalf. Each party had the right to dispose of its share of refinery products, with the normal throughput working out to 150,000 barrels per day for Bahrain and 100,000 barrels per day for Caltex.

To permit the Government to build up its own marketing organization, and to allow Caltex to continue to fulfill its contracts, both sides agreed on a buy-back arrangement, where the Government will sell Caltex a portion of its entitlement over a 3 1/2-year period. The volume started at 135,000 barrels per day in the second half of 1980, and was to be reduced every year to 112,000 barrels per day in 1981, 70,000 barrels per day in 1982, and then phased out entirely by 1983. Banoco was responsible for marketing about 3% of the refinery's output locally within Bahrain.

Banoco also became responsible for directing new exploration efforts for oil and gas. Most exploration was concentrated in the offshore Persian Gulf region. A 12-month, $15 million seismic exploration survey was initiated during the year by Western Geophysical Co. of Houston, Tex. (United States). The survey was funded by the Bahrainian Government along with the Kuwait Oil Co.

Bahrain's reserves of natural gas were becoming increasingly important in light of the decline in oil production. Approximately 140 billion cubic feet of natural gas was produced during the year, most of it was associated gas from crude oil production. An estimated 9 trillion cubic feet of nonassociated gas reserves was located in the Permian Khuff Formation, which underlies the oil-producing Bahrain Formation. The Bahrain National Gas Co. (Banagas) was formed in 1979 to utilize the previously flared natural gas. Banagas was composed of Banoco (75%), Caltex (12.5%), and the Arab Petroleum Investment Corp. (12.5%). Banagas fed most of the associated gas into the domestic distribution system, which became the power source for local industry. Aluminum Bahrain (ALBA) received 85% of its energy requirements from this tailgas. The remainder of the associated gas was fed to the newly completed natural gas liquids (NGL) plant. The plant was built by the Japan Gasoline Co. for $72 million, and the first shipment of liquids was made in March 1980. The plant was designed to utilize 100 million cubic feet per day of associated gas to produce 280,000 tons per year of NGL, 80,000 tons of propane, 79,000 tons of butane, and 125,000 tons of naphtha (natural gasoline). Output of the Banagas facility was sold to Caltex, which was responsible for marketing.

The volume of Khuff gas, or nonassociated gas produced, ranged from 250 million cubic feet to 460 million cubic feet per day, depending on the season. The output is sold to Bapco (88 million cubic feet per day), with the remainder going to the aluminum extrusion plant and local power stations. The use of air-conditioners in the summer explains the increased usage of gas by the power stations.

In other petroleum-related activities, Bahrain, Kuwait, and Saudi Arabia signed a joint venture agreement to establish the Gulf Petrochemicals Industries Co., which was capitalized at $160 million. Initial contracts for the complex were awarded during 1980. The complex was to produce 1,000 tons per day of methanol and 1,000 tons per day of ammonia. Production was scheduled to begin in 1983. Wimpey laboratories (United Kingdom) won a site survey and soil analysis contract for the plant, which was to be located on a 600,000-square-kilometer site to be reclaimed from the sea. King Wilkinson International of Houston, Tex. (United States), was awarded a $9 million contract for initial feasibility studies, and Uhde (Federal Republic of Germany) won a contract for processing technology and technical expertise.

Bahrain's effort to diversify its economy away from the oil sector was centered on several industrial projects, the most established of which was ALBA, which has been operating since 1971. Aluminum production was again slightly above capacity, at 126,000 tons in 1980. Capacity was to be upgraded to 170,000 tons per year in 1981 through the addition of two new potrooms. The Government owned the majority share (57.9%), with Saudi Arabia holding 20% of the equity, and Kaiser Aluminum Bahrain (United States) and Breton Investments (United Kingdom) owning 17% and 5.1%, respectively. The minority shareholders exported their share of production as standard ingots or ran the metal through the aluminum powder plant, Bahrain Atomiser International, in which Breton has an interest through Eckhardtwerke A.G. (Federal Republic of Germany). The Bahrain and Saudi

share of the output was handled by Bahrain Aluminum Co. (Balco), which is the marketing company for ALBA. Revenues from the export of aluminum were down slightly to $96 million, because Balco held back some of its stock awaiting price increases.

Negotiations were underway for Bahrain to host a six- or seven-member partnership in the Gulf Aluminum Rolling Mill Co. The plant was to produce 40,000 to 60,000 tons per year of semifabricated aluminum products. Equity holders were expected to be Bahrain, Kuwait, Saudi Arabia, and Iraq at 20% each, and Oman and Qatar at 10% each. Production was tentatively scheduled to start at the end of 1983. The mill was to be supplied aluminum ingots from ALBA.

The Bahrain Aluminum Extrusion Co. (Balexco), a Government-owned company, was in the process of upgrading capacity by one-third through the installation of additional anodizing facilities. Balexco has maintained its output at about 3,600 tons per year for the last 2 years.

Also in the planning stage was an iron ore pelletizing plant, to be set up in Bahrain by 1985. The Arab Iron and Steel Co. was formed as a joint venture of Kuwait, Bahrain, the United Arab Emirates, private companies, and other gulf lending organizations. The company was capitalized at $150 million. The project was to produce 4 million tons per year of iron pellets, to be exported to neighboring gulf countries. Bahrain hoped to establish a steel industry sometime in the future.

A joint venture to produce cement came onstream during 1980. The Saudi-Bahraini Cement Co. opened its first kiln late in 1980 and began producing about 1,500 tons per day. The plant, which was located in Saudi Arabia, was designed to produce 6,000 tons per day of cement, making it one of the largest plants in the Middle East. Bahrain was to receive one-half of the plant's output.

Bahrain's major infrastructure project, besides the profitable Arab Shipbuilding and Repair Yard and the modernized Port of Mina Sulman, was the Saudi-Bahrain Causeway. A consortium, led by Ballast Nedam (Netherlands) and including Mitsubishi Metal Corp. of Japan and Bandar Trading and Contracting Co. (Saudi Arabia), was selected to build the set of bridges linking Jasra in Bahrain to Khobar in Saudi Arabia. The contract was valued at $564 million. The causeway was expected to have immense implications for the island nation's economy.

Table 2.—Bahrain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	168,015	131,021	--	Japan 46,748; India 20,998; Republic of Korea 10,893.
Copper metal including alloys, all forms	762	13	--	Kuwait 9.
Iron and steel metal:				
Scrap	200	36	--	India 31.
Pig iron, ferroalloys, similar materials	--	18	--	All for ship stores.
Steel, primary forms	109	380	--	Do.
Semimanufactures	13,902	7,972	--	Ship stores 7,951.
Lead metal including alloys, all forms	7	1	--	All for ship stores.
Nickel metal including alloys, all forms	--	2	--	Do.
Silver metal including alloys, unwrought and partly wrought value, thousands	$54	--		
Zinc metal including alloys, all forms	--	12	--	All for ship stores.
Other: Base metals including alloys, scrap	20	7	--	Do.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	9	2	--	Do.
Cement	6,110	1,716	--	Ship stores 1,713.
Clay products: Nonrefractory	182	--		
Fertilizer materials: Manufactured	1	--		
Lime	1,099	521	--	Saudi Arabia 496; United Arab Emirates 21.
Stone, sand and gravel:				
Dimension stone, worked	40	4	--	All for ship stores.
Sand excluding metal-bearing	76	109	--	Do.
Other	--	1	--	Do.

See footnotes at end of table.

Table 2.—Bahrain: Exports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Other:				
Slag, dross, similar waste, not metal-bearing	51	--		
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	423	391	--	All for ship stores.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	NA	24	--	Do.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	10,517	8,586	--	United Arab Emirates 3,733; Australia 1,238; New Zealand 795.
Kerosine and jet fuel do	12,099	20,170	--	United Arab Emirates 4,270; Australia 1,556; Philippines 973.
Distillate fuel oil do	[1]26,282	23,399	--	United Arab Emirates 6,662; Japan 2,580; Suadi Arabia 1,892.
Residual fuel oil do	27,667	30,404	--	Democratic Republic of Yemen 9,030; New Caledonia 4,427; Japan 3,322.
Lubricants do	328	296	--	India 176; Philippines 70; Australia 46.
Liquefied petroleum gas do	NA	351	--	Mainly to United Arab Emirates.
Unspecified do	9,887	1,433	--	United Arab Emirates 956; Qatar 417.

NA Not available.
[1]Includes bunker loadings.

Table 3.—Bahrain: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	758	1,013	53	France 275; United Kingdom 147; West Germany 97.
Copper:				
Ore and concentrate	1	--		
Metal including alloys, all forms	9,726	1,246	43	Japan 425; Singapore 300; United Kingdom 231.
Iron and steel metal:				
Scrap	5	7	--	All from West Germany.
Pig iron, ferroalloys, similar materials	426	105	2	Kuwait 40; Italy 20.
Steel, primary forms	77	29,273	5,649	Japan 10,426; Republic of Korea 5,649.
Semimanufactures:				
Bars, rods, angles, shapes, sections	37,349	--		
Universals, plates, sheets	13,510	11,896	2,164	Japan 6,591; Republic of Korea 869; United Kingdom 827.
Hoop and strip	1	--		
Rails and accessories	35	--		
Wire	125	194	14	West Germany 72; Belgium-Luxembourg 34.
Tubes, pipes, fittings	15,566	13,059	438	Japan 4,029; Saudi Arabia 1,875; United Kingdom 827.
Castings and forgings, rough	[1]	--		
Lead metal including alloys, all forms	29	387	2	Finland 350.
Nickel:				
Ore and concentrate value, thousands	--	$1	--	All from United Kingdom.
Metal including alloys, all forms	[1]	3	--	United Kingdom 2; West Germany 1.
Platinum-group metals including alloys, unwrought and partly wrought value, thousands	$10	$24	$1	United Kingdom $22.
Silver metal including alloys, unwrought and partly wrought do	$158	$7	$1	United Kingdom $6.

See footnotes at end of table.

Table 3.—Bahrain: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Tin metal including alloys, all forms	(1)	17	--	United Kingdom 9; Australia 8.
Zinc metal including alloys, all forms	67	44	--	United Kingdom 29; Denmark 14.
Other base metals including alloys, all forms	350	1,108	708	Singapore 222; Japan 74.
NONMETALS				
Abrasives, n.e.s.:				
Natural value, thousands	$8	$4	--	All from France.
Grinding and polishing wheels and stones	18	22	--	China, mainland 7; Japan 5; Republic of Korea 5.
Asbestos, crude	--	14	--	Mainly from Netherlands.
Cement	604,307	187,739	67	Japan 106,661; Italy 15,099.
Clay products:				
Refractory including nonclay brick	3,416	1,691	128	United Kingdom 768; West Germany 466; Italy 249.
Nonrefractory	33,631	7,985	40	Italy 5,103; Spain 969; United Kingdom 706.
Diamond: Gem, not set or strung value, thousands	$3	$56	--	United Kingdom $41; Belgium-Luxembourg $10.
Fertilizer materials:				
Crude	19	149	--	Kuwait 101; Vanuatu 25.
Manufactured	335	858	--	Australia 358; West Germany 299.
Gypsum and plasters	4,985	130,079	24	United Arab Emirates 129,884.
Lime	585	319	2	Republic of Korea 136; United Kingdom 133.
Mica, worked	--	590	2	Republic of Korea 587.
Precious and semiprecious stones except diamond value, thousands	$19	$13	--	India $6; Austria $4.
Salt	841	1,110	35	Netherlands 570; China, mainland 270; Hong Kong 121.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	304,185	16,980	37	United Arab Emirates 16,589.
Worked	159	73,348	21	United Arab Emirates 71,633.
Gravel and crushed rock	--	112,094	--	United Arab Emirates 108,689.
Sand excluding metal-bearing	83	332	--	Netherlands 230; United Kingdom 76.
Other:				
Slag, dross, similar waste, not metal-bearing	78	6,820	--	All from Spain.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	6,218	2,438	15	United Kingdom 864; India 664; Republic of Korea 310.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	33	33	
Coal, all grades including coke and briquets	(1)	32,795	32,777	United Kingdom 6.
Petroleum and refinery products:				
Crude and partly refined thousand 42-gallon barrels	70,237	72,472	--	All from Saudi Arabia.
Refinery products:				
Gasoline 42-gallon barrels	NA	85	--	Iran 76.
Kerosine and jet fuel do.	NA	326	140	West Germany 101; United Kingdom 78.
Distillate fuel oil do.	NA	112	75	Lebanon 30.
Residual fuel oil do.	NA	8,079	7	Australia 8,032.
Lubricants do.	NA	53,480	4,600	United Arab Emirates 22,554; Singapore 10,640.
Liquefied petroleum gas do.	162	360	23	United Kingdom 151; United Arab Emirates 93.
Unspecified do.	425,173	781,872	583,933	Australia 166,082.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	8	--		

NA Not available.
[1]Less than 1/2 unit.

JORDAN

The mineral industry in Jordan consisted of the mining of phosphate rock, petroleum refining, the production of cement, and the mining and quarrying of various building materials. The mining industry continued to increase its share of the total GDP from 20% of the $2.3 billion[4] in 1979 to about 22% of the $2.9 billion GDP in 1980, mainly owing to an increase in the production of phosphate rock and an increase in the price of refined petroleum products. The mineral sector was to continue to expand over the next several years, with production commencing from the Dead Sea potash project and the Aqaba phosphate fertilizer complex in 1982.

Jordan's economy continued to prosper in 1980, with an overall growth in the gross national product (GNP) of 23%, from $2.9 billion in 1979 to $3.6 billion in 1980. The overall index of industrial production showed a 23% increase over that of 1979, with phosphate rock production leading the way. Also adding to the economic upswing was a bumper crop in the agricultural sector, where production of wheat and other grains was up an average of 500%. To maintain the combination of high industrial production and agricultural output, the new 1981-85 5-year development plan concentrated on industry and mining (21%), and irrigation, water projects, and agriculture (20%).

Despite the substantial growth in Jordan's GNP over the last several years, the country has experienced chronic and growing trade deficits. The oil import bill alone equaled all export earnings. Although exports increased by 42% and imports increased only 23% from that of 1979, the difference in absolute terms was a $3.2 million increase in the merchandise trade deficit from $1.55 billion in 1979 to $1.86 billion in 1980. As in previous years, the deficit was more than made up for in receipts from tourism, official loans and aid grants, and remittances from Jordanians working abroad. Receipts from these three sources in 1980 were $516 million, $1.3 billion, and $795 million, respectively. With these revenues, the overall balance of payments showed a surplus of $334 million for the year. Jordan's merchandise trade balance was also expected to improve in the coming year. Since 1977, imports of capital goods have exceeded imports of consumer goods. Industrial production was expected to increase significantly when this capital growth becomes productive, probably within the early part of the decade.

The production of phosphate continued to be Jordan's major mineral industry in 1980. Output increased from 2.8 million metric tons in 1979 to over 3.9 million metric tons in 1980. The substantial increase in output was due to production from the newly opened mines at Wadi-El-Abyad. Exports of phosphates amounted to 3.61 million tons in 1980, which brought in revenues of $156 million. Jordan's phosphate production has increased rapidly since 1977. This increase was the result of careful management by the Jordan Phosphate Mines Co. (JPMC) in maintaining production levels at the earliest mining center, Ruseifa, the progressive expansion of the second center, El Hasa, and the development of a new mining and milling operation at Wadi-El-Abyad.

At Ruseifa, 14 kilometers from Amman, phosphate production began in 1937, and output has been maintained at approximately 800,000 tons per year since 1960. The phosphate occurs in beds from 1.5- to 3-meters thick, with an average triphosphate of lime (TPL) content of 62% to 72%.

At El-Hasa, 138 kilometers south of Amman, the JPMC and its contractors were conducting six mining operations on five separate ore bodies. The phosphorite at El Hasa occurs in two horizons, the upper of which is usually 2.5 to 3 meters thick with an average 62% to 75% TPL content. The lower horizon ranges from 2- to 9-meters thick but is not being worked. Proven reserves at El Hasa were 105 million tons. The mining rate of El Hasa has increased from 1.7 million tons in 1979 to over 2.2 million tons in 1980, and was expected to rise to over 6 million or 7 million tons within a 5-year period.

A new mine site came onstream during the year at Wadi-El-Abyad, about 20 kilometers north of El-Hasa. Output from the mine in 1980 was about 900,000 tons, with an average content of 68% TPL. The phosphorite beds at Wadi-El-Abyad were similar in structure to El-Hasa, and proven reserves were put at 72.5 million tons. Only one ore body out of three is currently being worked, but plans were to increase output from the new location to 3 million tons per year by 1985.

Two milling and beneficiation plants were operating in 1980, one at El-Hasa, and a new plant at Wadi-El-Abyad. At El-Hasa, five separate crushers fed phosphate rock into five beneficiation plants, three with a

500,000-ton-per-year capacity and two with an 800,000-ton-per-year capacity. Output from the plant was 72% to 75% TPL, with a moisture content of 18%. The material was loaded onto rail cars at 600 tons per hour, or onto trucks at 1,500 tons per hour. The ore mills at Wadi-El-Abyad consist of three 500,000-ton-per-year process lines with an output of 72% to 73% TPL, or 73% to 75% TPL, which is transported by road to the rail line at El-Hasa.

Jordan's future in the phosphate mining industry was guaranteed by the large but unexploited reserves at Esh-Shidiya, located several kilometers south of Ma'an near Hitiya. Reserves at Esh-Shidiya were estimated at 923 million tons. The JPMC has entered into various negotiations concerning development, but no plans have been made, and exploitation was unlikely before 1990.

Beginning in 1982, the JPMC will begin delivering some product to the Jordan Fertilizer Industry Co.'s (JFI) new fertilizer complex just south of Aqaba. The JFI was formed in 1975 as a joint venture with Agrico (United States) and American Fertilizer Co. The main contractor for the plant was Spie Batignolles (France) using Rhone-Poulenc phosphoric acid process technology. Heurtey Industries (France) was contracted to build the sulfuric acid plant. Agrico pulled out of the project in 1977, and the Jordan Government took up its stake and appointed Mitsui Toatsu (Japan) to supervise the work. Current shareholders in the company were the Jordan Government (26%), JPMC (25%), the Arab Mining Co. (10%), and the International Finance Corp. (5%) along with several other Arab financial institutions and Jordanian private interests.

The plant, being built at an estimated cost of $300 million, is composed of two 650,000-ton-per-year sulfuric plants, a 400,000-ton-per-year phosphoric acid unit, and two granulated diammonium phosphate or nonammonium phosphate plants, each with a 900,000-ton-per-year capacity. All of the units were scheduled for completion at the end of 1981, and commissioning was expected to take 5 months, with commercial production starting in early or middle 1982. The sulfur and ammonia for the plant were to be imported from neighboring Middle Eastern countries. These imports, along with exports of fertilizer and potash, were to be handled by a marine terminal being constructed by the Government adjacent to the JFI complex, near the border of Saudi Arabia. The terminal was to be capable of handling vessels of 30,000 to 50,000 deadweight tons. The fertilizer plant was also to include a $30 million subplant for the production of aluminum fluoride.

Jordan's single largest industrial venture, the Dead Sea potash project, was under construction in 1980. The $425 million operation was scheduled for completion in 1982. The project was initiated by the Arab Potash Co. (APC), a joint venture of the Jordan Government (51%), the Arab Mining Co. (25%), the Islamic Development Bank (7%), and a combination of other Arab Governments and minority shareholders. George Wimpey and Co. (United Kingdom) won a $131 million contract for construction of the solar evaporation ponds and the surrounding dikes. The potash was to be recovered using carnallite harvesting machines, four of which were purchased from R. A. Hanson Co. (United States) at a cost of over $2 million each. Vöest Alpine (Austria) won a $107 million contract to erect a potash-processing refinery to be located about 1 kilometer from the evaporation ponds.

The potash recovery project begins with Dead Sea brines, which are to be pumped from an offshore area about 1 kilometer from the Lisan Peninsula to a canal, which conveys the brine 10 kilometers by gravity to the salt pan, where solar evaporation occurs. This first pan was to precipitate common salt (NaCl). The brine is then pumped to two smaller precarnallite pans, where additional sodium chloride is precipitated. The carnallite saturated brine then flows into three parallel carnallite pans, where carnallite, a potassium chloride, and magnesium chloride double salt ($KCl.MgCl_2.6H_2O$) precipitate along with about 15% common salt. The carnallite is recovered using the laser-controlled harvesting machines, which crawl along, semisubmerged, on wide caterpillar tracks. The carnallite layer is scooped up and pushed into a pipeline, which leads to dewatering cyclones. The final solids produced total 310 tons per hour. In the refinery, MgCl is leached out, creating synthetic sylvanite (potassium and sodium chloride). The KCl is separated using differential solubilities, and then potash is recrystalized, dewatered, dried, and stored. The refinery can produce 1.2 million tons per year of potash.

Potash is to be trucked by road to Aqaba, and exported by ship from there. Potash marketing was contracted to Mitsubishi (Japan) for Asia (600,000 tons per year), Woodward and Dickerson (United States)

for North and South America (275,000 tons per year), Entreprise Minière et Chimique (France) for Western Europe and Africa (250,000 tons per year), IMIC Holdings for Eastern Europe (40,000 tons per year), and the APC for the Middle East (35,000 tons per year). Exports were to begin late in 1982 or 1983.

Jordan's cement production in 1980 averaged about 800,000 tons, which was supplied by the Jordan Cement Co.'s existing facility at Fuheis, 25 kilometers northwest of Amman. An additional production line at the plant came onstream during the year, increasing capacity from 600,000 to 1.2 million tons per year, but still left production short of demand. To satisfy domestic requirements as well as provide some surplus for export, the Jordan Cement Co. planned to double the capacity at Fuheis and build a second plant at Rashidiyah.

A consortium, led by Mitsubishi and including Kobe Steel Ltd. (Japan), was awarded a $120 million contract to expand capacity at the Fuheis cement plant to 2 million tons per year, through the addition of a sixth production line. The new line was to produce nearly 1 million tons annually, or as much as the five existing lines at the plant. The plant was scheduled for completion in November 1982.

Another contract, worth $224 million, was awarded to the same consortium for construction of a 2-million-ton-per-year cement plant at Rashidiyah, 20 kilometers south of Amman. To finance the plant, Mitsubishi extended to Jordan a $116 million loan, at 7.75% interest per year. The loan was to be repaid semiannually over 8 years beginning in 1985. This plant was to be completed in September 1983.

Jordan's petroleum industry consisted of the refining of petroleum at the Jordan Petroleum Refinery Co.'s plant located at Zarqa. The refinery had a total input capacity of 35,000 barrels per day of crude oil and produced over 12 million barrels of refined products in 1980. Crude oil feedstock was supplied by Saudi Arabia through the Trans-Arabian Pipeline (TAPline). Industrialexport of Romania was supervising expansion of the refinery, to handle 90,500 barrels per day, but expansion was delayed several months during the year, and the new completion date was March 1981.

Petroleum exploration in Jordan, although unsuccessful to date, was continuing in 1980. The Jordanian Natural Resources Authority commissioned a $4.2 million, 6-month seismic survey to be conducted by the French prospecting firm Cie, Générale de Gèophysique and Geophysical Services (United States). The areas to be explored were al-Azraq, al-Sorhan, al-Rayshah, al-Jafr, and the Jordan Valley. Potential sites for exploratory wells were to be determined on the basis of the survey. The new 1981-85 5-year plan also called for a nationwide oil search at a cost of about $75 million, to be supervised by the Natural Resources Authority.

Jordan also had large reserves of oil shale, with reserves estimated at about 30 billion tons. Klockner and Lurgi (Federal Republic of Germany) was contracted to do a $630,000, 17-month prefeasibility study for a 50,000-barrel-per-day shale retorting plant at Lajjun, near Karak in central Jordan. Proven reserves at Lajjun were 1.3 billion tons, and in places the shale was in excess of 400-meters thick.

Table 4.—Jordan: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	450	1,069	--	United Arab Emirates 414; Lebanon 404; Syria 228.
Copper metal including alloys, all forms	236	1,324	--	United Arab Emirates 560; India 213; Lebanon 156.
Iron and steel metal:				
Scrap	3,915	11,574	--	Lebanon 10,363; Egypt 598; Saudi Arabia 446.
Unwrought and semimanufactures	5,193	7,994	--	Iraq 5,849; Syria 1,057; Saudi Arabia 866.
Lead:				
Oxides	--	36	--	All to United Kingdom.
Metal including alloys, all forms	768	1,780	--	Turkey 550; Italy 246; Denmark 243.
Zinc:				
Oxides	60	47	--	Saudi Arabia 32; Czechoslovakia 15.
Metal including alloys, all forms	171	173	--	Syria 93; Saudi Arabia 79.

See footnotes at end of table.

Table 4.—Jordan: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS —Continued				
Other: Ash and residue containing nonferrous metals	1,310	766	--	Denmark 313; Lebanon 287; West Germany 149.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Emery	--	12	--	All to Saudi Arabia.
Grinding and polishing wheels and stones	8	4	--	Mainly to Saudi Arabia.
Cement	240	--		
Chalk	740	107	--	All to Saudi Arabia.
Clays and clay products:				
Crude clays	--	13,286	--	Lebanon 11,656; Kuwait 1,197.
Products including nonclay refractory brick	3,110	4,066	--	Syria 1,990; Saudi Arabia 1,174.
Fertilizer materials:				
Crude:				
Phosphatic thousand tons	2,160	2,755	NA	NA.
Other including mixed	--	50	--	All to United Arab Emirates.
Manufactured:				
Nitrogenous	--	122	--	United Arab Emirates 95; Qatar 10; Lebanon 9.
Phosphatic	--	68	--	United Arab Emirates 47; Lebanon 19.
Gypsum and plasters	--	129	--	Saudi Arabia 87; Kuwait 42.
Lime	--	36	--	All to Saudi Arabia.
Pigments, mineral: Natural crude	62	--		
Salt and brines	--	554	--	Iraq 274; Lebanon 170; Qatar 100.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	29	145	--	Lebanon 84; Syria 61.
Caustic potash	21	--		
Sodic and potassic peroxides	45	24	--	All to Syria.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	97,914	111,583	--	Syria 89,411; Kuwait 7,247; Lebanon 6,758.
Worked	53,904	62,227	--	Kuwait 48,741; Saudi Arabia 7,024; Iraq 5,283.
Gravel and crushed rock	--	2,604	--	Syria 2,069; Lebanon 251; Saudi Arabia 180.
Sand excluding metal-bearing	5,041	8,098	--	Lebanon 3,924; Kuwait 1,957; Saudi Arabia 1,653.
Sulfur: Sulfuric acid, oleum	196	217	--	All to Saudi Arabia.
Other:				
Oxides, hydroxides, peroxides of strontium, magnesium, barium	--	5	--	Do.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	39	121	--	Do.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	12,723	14	--	Do.
Coke and semicoke	31	--		
Petroleum refinery products:				
Gasoline 42-gallon barrels	2,226	2,391	--	Saudi Arabia 1,349; Lebanon 686; Syria 356.
Kerosine do	--	142	--	All to Saudi Arabia.
Residual fuel oil do	1,734	--		
Lubricants do	2,111	956	--	Syria 602; India 311.
Liquefied petroleum gas do	313	--		

NA Not available.

Table 5.—Jordan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	--	110	--	United Kingdom 53; Syria 43.
Metal including alloys, all forms	4,474	4,704	30	Greece 2,038; Lebanon 877; Taiwan 250.

See footnotes at end of table.

Table 5.—Jordan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Copper metal including alloys:				
Unwrought including matte and scrap	67	442	--	West Germany 400; Saudi Arabia 26; Sweden 14.
Semimanufactures	r527	626	2	United Kingdom 387; Belgium 40; Poland 33.
Gold metal including alloys, unwrought and partly wrought troy ounces	--	4,823	1,608	Saudi Arabia 3,215.
Iron and steel metal:				
Scrap	2,384	5,852	--	West Germany 3,494; Kuwait 1,261.
Pig iron, ferroalloys, similar materials	r6,812	20,545	37	Mozambique 10,531; Lebanon 4,241; Poland 3,179.
Steel, primary forms	56,728	69,199	--	Argentina 15,000; Poland 12,564; Greece 10,000.
Semimanufactures:				
Bars, rods, angles, shapes, sections	70,752	190,859	1,055	Mozambique 36,383; Finland 26,344; Italy 25,686.
Universals, plates, sheets	r32,211	62,446	90	Japan 22,245; France 9,995; East Germany 5,013.
Hoop and strip	--	515	--	Iraq 210; Lebanon 146.
Rails and accessories	--	96	--	West Germany 33; Syria 26; Netherlands 23.
Wire	r4,817	4,998	(1)	Romania 1,204; Poland 879; China, mainland 813.
Tubes, pipes, fittings	r19,708	69,350	18	West Germany 21,344; Italy 10,137; United Kingdom 6,528.
Unspecified	1,059	384	--	Japan 216; Belgium 100; Poland 54.
Lead:				
Oxides	348	302	--	United Kingdom 155; Italy 92; France 55.
Metal including alloys, all forms	r3,787	1,481	--	Mainly from Saudi Arabia.
Tin metal including alloys:				
Unwrought including scrap	3	--		
Semimanufactures	12	10	--	All from West Germany.
Titanium oxides	691	2,188	--	Lebanon 987; United Kingdom 456; Belgium 278.
Zinc:				
Oxides	242	185	--	West Germany 162; Italy 20.
Metal including alloys, all forms	394	1,127	2	Japan 632; Belgium 205; U.S.S.R. 127.
Other:				
Ores and concentrates	--	168	--	Italy 100; Syria 58; Morocco 10.
Ash and residue containing nonferrous metals	--	1,090	--	Syria 938; Saudi Arabia 141.
Metals:				
Alkali, alkaline-earth, rare-earth metals, mercury	--	147	(1)	Spain 61; Norway 60; Lebanon 18.
Base metals including alloys, all forms	30	22	--	Lebanon 12; Turkey 10.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	152	560	--	Mainly from Syria.
Grinding and polishing wheels and stones	273	271	(1)	Italy 215; West Germany 32.
Asbestos, crude	392	2,332	--	Lebanon 2,057; Cyprus 275.
Cement	r622,595	678,816	9	Spain 481,270; Lebanon 121,102; Italy 54,883.
Chalk	3,788	4,760	--	United Kingdom 2,794; Syria 689; France 537.
Clays and clay products:				
Crude clays	816	823	4	United Kingdom 444; Cyprus 150; Kuwait 90.
Products:				
Refractory including nonclay brick	r2,680	891	18	United Kingdom 443; China, mainland 162; Lebanon 119.
Nonrefractory	r6,007	11,857	8	Italy 6,809; Lebanon 1,760.
Cryolite and chiolite	--	67	--	Belgium 38; Lebanon 29.
Diatomite and other infusorial earth	--	212	10	Greece 200.
Feldspar and fluorspar, etc	289	415	--	Italy 200; Sweden 113; Norway 100.
Fertilizer materials:				
Crude and manufactured:				
Nitrogenous	18,437	15,180	--	Iraq 10,291; France 1,754; Lebanon 1,324.
Phosphatic	12,024	19,784	2	Lebanon 14,697; Iraq 1,865; Kuwait 1,805.
Potassic	1,850	994	--	West Germany 600; Iraq 195; Kuwait 110.

See footnotes at end of table.

Table 5.—Jordan: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials —Continued				
Crude and manufactured —Continued				
Other including mixed	r1,846	3,909	2	Kuwait 1,040; Netherlands 824; United Kingdom 637.
Ammonia		251	--	Syria 158; Kuwait 36.
Gypsum and plasters	1,992	1,337	--	Syria 861; Lebanon 237; West Germany 220.
Lime	1,466	1,836	--	Mainly from Lebanon.
Pigments, mineral:				
Natural, crude	199	167	1	Syria 43; Belgium 41; West Germany 31.
Iron oxides, processed	3,849	1,108	--	Lebanon 942; Belgium 100.
Precious and semiprecious stones value	$192,465	$261,033	--	Belgium $249,149; Syria $10,064.
Salt and brines	1,410	1,739	20	Saudi Arabia 1,188; Kuwait 402.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	404	808	--	Italy 500; Romania 125; France 50.
Sodic and potassic peroxides	--	586	3	West Germany 507; China, mainland 50.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	9,697	8,034	--	Italy 6,682; Lebanon 776.
Worked	--	615	--	United Kingdom 256; Italy 178; Lebanon 144.
Dolomite, chiefly refractory grade	--	296	--	All from Italy.
Gravel and crushed rock	r1,973	2,069	--	Italy 1,020; Greece 798; Lebanon 178.
Sand excluding metal-bearing	486	1,340	14	Spain 751; Lebanon 371; United Kingdom 143.
Sulfur:				
Elemental:				
Other than colloidal	1,430	758	--	France 395; West Germany 135; Kuwait 100.
Colloidal	440	644	--	Iraq 337; Lebanon 167; Kuwait 100.
Sulfuric acid, oleum	1,253	713	--	Greece 434; Lebanon 106; Iraq 78.
Talc, steatite, soapstone, pyrophyllite	394	218	--	Norway 114; China, mainland 41; Taiwan 30.
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	2,234	2,662	46	Lebanon 2,068; France 157; Japan 124.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	1,004	--	--	
Coal, all grades including briquets	--	733	--	Lebanon 280; West Germany 206; Egypt 189.
Coke and semicoke	620	253	(1)	Lebanon 153; West Germany 75; Belgium 25.
Petroleum and refinery products:				
Crude				
thousand 42-gallon barrels	9,776	12,700	--	All from Saudi Arabia.
Refinery products:				
Gasoline - 42-gallon barrels	r2,375	109	(1)	Mainly from Iran.
Lubricants do	r107,198	126,825	21,013	Netherlands 30,321; Belgium 25,612; United Kingdom 11,052.
Mineral jelly and wax do	--	1,714	--	West Germany 786; Iraq 630.
Liquefied petroleum gas do	--	42,053	--	Iraq 38,671; Kuwait 3,380.
Petroleum coke, bitumen, other residue do	606	--		
Bituminous mixtures do	941	3,007	245	United Kingdom 1,243; Syria 870.
Unspecified do	1,384	1,114	30	Saudi Arabia 302; Belgium 271; Italy 164.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	133	--		

rRevised.
1Less than 1/2 unit.

LEBANON

The mineral industry in Lebanon consisted of the refining of imported petroleum, the production of cement, iron and steel products, gypsum, limestone, and salt. Despite the mineral sector's minor contribution to the overall economy, cement and iron and steel semimanufactured items ranked as the country's first and third

largest commodity exports, respectively. Lebanon's major exports and their relative percentage of total exports were cement (29%), lumber (25%), iron and steel (11%), construction materials (9.4%), and limestone and gypsum (3.1%).

Lebanon's economic situation remained relatively stable in 1980, despite continuing disruptions from political violence. The country's economy remained tied to its historical position as a major trading center for the Middle East, as well as a significant supplier of foreign labor. Exports from Lebanese ports in 1980 amounted to approximately $1.2 billion,[5] only 61% of which originated in Lebanon, the remainder being from other Middle Eastern countries. The Lebanese Chamber of Commerce estimated that this export figure represented only 70% of total exports, with the other 30% passing through small ports controlled by local militias, where no duties were collected.

Imports remained about the same as in 1979, about $2.3 billion, which left the country with a sizable merchandise trade deficit. The deficit was more than made up for by remittances from Lebanese workers abroad and loans from other Arab countries. Total Arab aid to Lebanon in 1980 amounted to almost $400 million, mostly from Iraq, the United Arab Emirates, Kuwait, and Saudi Arabia. These two factors left the country with a $700 million surplus in the balance of payments.

Lebanon's two refineries operated slightly below capacity in 1980, owing to disruptions in product distribution and damage to some of the refining units. The Mediterranean Refining Co. (Medreco) refinery in Zahrani in south Lebanon processed 6 million barrels of imported crude oil in 1980, which cost the company $155 million. The Medreco refinery was owned jointly by Caltex (50%) and Mobil Oil Corp. (50%), both U.S. companies. The Tripoli refinery, located in northern Lebanon, processed 11 million barrels of imported crude oil, which is equivalent to about 85% of its total capacity. The import bill for the refinery, which was owned by the Government, amounted to $287 million in 1980. Operations at the Tripoli refinery were shut down for several weeks in April 1980, when the distribution of refined products was halted for security reasons, and the storage tanks could not accommodate any additional production. Technical problems with some of the refining units at the Medreco refinery created a shortage of gasoline, which the Independent Fuel Fund supplemented by importing gasoline at a cost of $120 million. This brought Lebanon's total oil import bill to $562 million in 1980. Because of subsidies on the price of refined products in Lebanon, the Government had to bear an operating loss of $67.5 million for the Tripoli refinery. All of Lebanon's refinery feedstock was supplied by Saudi Arabia through the TAPline.

Cement production in Lebanon continued to exceed domestic demand in 1980, and revenues from cement exports reached $43 million in 1980. There were three cement plants operating in Lebanon in 1980, all located in Chekka. All three plants were owned by private interests within the country. Production capacity at the Société des Ciments Libanais plant was expanded from 1.2 million to 1.8 million tons per year in 1980. Also, production from the Cimenterie Nationale S.A.L. plant increased from 450,000 to 1 million tons per year in 1979. Capacity at the Société Libanais des Ciments Blanc remained the same in 1980, at 160,000 tons per year. Total production during the year was about 2.2 million tons, which was well below capacity, but large enough to provide a surplus for export.

Limestone and gypsum used in Lebanon's cement industry were quarried within the country. Lebanon's mountains provided a nearly inexhaustible source of limestone and large reserves of gypsum. Much of the country's production was used in the domestic cement industry, but a significant quantity, valued at $4 million, was exported.

Iron and steel production remained stable in 1980, at about 220,000 tons. Semimanufactured steel was produced at three plants, all using imported crude steel and scrap. The three plants were Consolidated Steel Lebanon S.A.L., in Bablos-Amchit; the Lebanon Steel Mill Co., in Tripoli; and Société Nationale des Tubes S.A.L., in Dekwaneh. Total capacity of the steel industry in Lebanon was approximately 400,000 tons of reinforcing bars, rounds, and galvanized steel pipes.

OMAN

Oman continued its efforts to develop its nonoil mineral resources in 1980, with emphasis placed on gas, copper, steel, and cement production. The sultanate remained dependent, however, on hydrocarbon resources to fuel this development. Oman's oil industry has turned around since 1978, when oil production was expected to continue its decline. New discoveries and new fields coming onstream have increased the

country's proven reserves, and production was expected to remain near its alltime high through the 1980's.

In terms of world production, Oman was a marginal producer, representing about 0.5% of world production, and it remained the smallest of all the Persian Gulf producers. In terms of the economy, however, oil and gas production was responsible for over 90% of the country's export earnings. Industry and agriculture, on the other hand, accounted for 2% of the GNP and 1% of export earnings, respectively. Government revenues from oil exports in 1980 amounted to $3.3 billion,[6] a 10% increase over the 1979 level despite a decrease in production from 1979. With oil production back on the rise, development spending has increased in 1980. New industries were expected to diversify Oman's economy, while the Government budget was able to maintain a surplus for the second consecutive year.

Oil production in Oman declined for the fourth consecutive year in 1980, with output averaging 287,000 barrels per day. Despite the decline, the industry's performance was considered excellent because production increased significantly in the second half of the year. Output for the first half of 1980 averaged 270,000 barrels per day, while in the second half production increased to over 300,000 barrels per day. The increased production was a result of two new fields coming onstream, both located in southern Oman. The first, the Amal-Marmul Oilfield, came onstream in September. Output from the three closely linked fields of Marmul, Birba, and Qaharir averaged 70,000 barrels per day through the remainder of the year. The producing fields were located in a concession held by Petroleum Development Oman (PDO), the majority state-owned company. PDO was owned 60% by the Government, 34% by Royal Dutch/Shell (Netherlands), 4% by Compagnie Francaise des Petroles (CFP)-Total, and 2% by Participation and Explorations Corp. (Partex) (Portugal).

Until the second half of 1980, PDO was the sultanate's only oil-producing company. In October 1980, however, Essence et Lubricants de France (Elf)-Aquitane (France) brought into production its Sahmah Oilfield, located in the Butabul region, 550 kilometers southwest of Muscat near the Saudi Arabian border. Two wells, Sahmah 1 and Sahmah 3, were discovered in 1979 by a concession operated by a consortium composed of Elf-Aquitane (48%), Sumitomo Metal Mining Co. Ltd. (Sumitomo) (Japan) (32%), and Wintershall A.G. (Federal Republic of Germany) (20%). The wells began producing 12,000 barrels per day in October, and continued at that rate through the end of the year. Sahmah crude oil had an API gravity of 43.5° and a sulfur content of 0.14%.

The southern Dhofar Province fields, which were discovered in the late 1970's, have been linked to the older northern fields and the existing export terminal through construction of a 455-kilometer, 18-inch pipeline, with a 70,000-barrel-per-day capacity. Dodsal Private Ltd. (India) completed the pipeline in December 1980, under the engineering and construction management of Kellogg Continental B.V. The main portion of the line runs from the Marmul Fields, northward to the Qarn Alam Fields and into the existing pipelines, which link up with the main terminal at Mina-a-Fahal near Muscat. The line cost an estimated $73 million. A separate spur line links the Sahmah Field to the Marmul pipeline, with the southern fields linked to the northern fields at Qarn-Alam, Fahud, Lekhwair, Yibal, and Natih, total capacity of Oman's oil industry was approximately 350,000 barrels per day. The country's production for the next 5 years is to average 330,000 barrels per day.

The new pipeline was constructed to bypass new discoveries made during 1980, but not yet in production. The recent discoveries in the southern Dhofar Province spurred exploration in the area, with several oil strikes resulting in 1980. The most important discovery was the Rima Oilfield in PDO's concession, 140 kilometers northeast of Marmul. Four appraisal wells were drilled during the year, which produced 33° API oil from a sandstone reservoir. PDO planned to spend $140 million on development of the field. The pipeline passed over the Rima Field, and gas from the nearby Birba Field was to provide electricity for field development and a pump station at Rima.

Exploration was continuing elsewhere in Oman. Amoco Oman Oil Co., a subsidiary of Standard Oil Co. of Indiana (United States), was awarded a production sharing concession covering 49,000 square kilometers offshore northeast Oman. Amoco was to spend $70 million on exploration over 7 years. Amoco also holds 85.5% of another offshore concession, along with Deutsche Schachtbau (Federal Republic of Germany) and Wintershall A.G. The concession extends from Masirah Island to Sauquirah Bay off the coast of southeast Oman.

Another consortium, including the Japa-

nese Sumitomo Petroleum Development Co. (operator), Elf-Aquitane, International Energy Development Corp. (Netherlands), and the Kuwait Petroleum Corp., was to begin exploring for oil in the eastern part of the country. The group was to spend $130 million on exploration over a 6- or 7-year period.

These new discoveries in Oman have allowed PDO to raise its figures for recoverable oil reserves by 61%, from 1.5 billion to 2.44 billion barrels. With the projected production level for the decade at 330,000 barrels per day, Oman's reserves are expected to last another 25 to 30 years.

The Government was planning to build its first oil refinery at Mina-al-Fahal. Japan's Mitsui Co. won a contract worth $75 million to build the refinery. The plant, with a capacity of 50,000 barrels per day, was to begin production in 1982. Oman previously imported petroleum products from Bahrain and the United Arab Emirates at the rate of 3.5 million barrels per year. The refinery was expected to meet the country's domestic requirements and provide a substantial surplus for export.

Natural gas was also becoming an important commodity for Oman. Gas development was centered around the Yibal Gasfield, where reserves of nonassociated gas were estimated at 5 trillion cubic feet. Oman's NGL plant, located near Muscat, came onstream late in 1979. The gas was transported from Yibal, near the Saudi border, to Muscat by way of a 20-inch, 325-kilometer pipeline. Another gas liquefaction plant was under construction at Fahud, and plans were made to construct a similar unit at Lakhwair.

Yibal gas was also used to fuel the 225-megawatt power generation-desalinization complex at al-Ghubra. Gas was transported by pipeline to al-Ghubra. Oman planned to extend the pipeline along the coast to Sohar, to be used in the $120 million copper mining and smelting complex of the Oman Mining Co. The Ministry of Petroleum and Mineral Resources signed a $40 million contract with Dodsal Private Ltd. to build the pipeline. In addition to providing fuel for the smelter, the gas was to be used in the industrial area of Rusayl. PDO was also constructing a liquefied petroleum gas (LPG) plant at Yibal. The plant was to produce propane, to be used in the cooling systems of the company's gas plant, and butane, which was to be supplied to a local company for bottling. Lean residue gas was to be fed into the al-Ghubra pipeline, while condensate above propane was to be fed into the crude oil stream to upgrade heavier crude oil for export.

Oman's major nonoil mineral development project was the Sohar copper mine and smelter, under construction by the Oman Mining Co. (OMC). The OMC was set up in 1978 to exploit copper deposits near the Gulf of Oman. Original shareholders in the company were the Omani Government (75%); Marshall Oman Exploration Inc., a subsidiary of the U.S. Marshall Group (22.5%); and Prospection Ltd. of Canada (2.5%). In April 1979, the Government took over Marshall Oman's equity share and, in May 1980, the company completed the takeover by buying out Prospection Ltd.

The copper project was to mine three deposits, Lasail, Aarja, and Bayda, all located about 25 kilometers west of Sohar. Reserves at the deposits were estimated at 8 million, 3 million, and 1 million tons, respectively. The mining rate was to be about 3,000 tons per day, giving the mine a life of 11 to 12 years. The mining method to be used was trackless sublevel caving, with access to the deposit by declines. By the end of 1980, the main shaft and several secondary shafts had been dug.

Plans were finalized in 1980 for a 20,000-ton-per-year electrolytic refinery to be built adjacent to the mine. Initial plans were only for production of concentrated and blister copper, but higher metal prices and the potential for recovering gold and silver slimes led to plans for a refinery. The mine, concentrator, and refinery were expected onstream sometime in mid-1982. Power for the entire complex was to be supplied by a new 30-megawatt power station, to be supplied by General Electric Co. (United States). The plant was to be fueled by gas from the Muscat pipeline.

The sultanate's other large industrial project was a cement plant, currently under construction at the industrial center of Rusayl. The project was initiated by the Oman Cement Co., originally owned jointly by the Oman Government (60%) and the Kuwait Cement Co. (40%). The Kuwaitis withdrew from the company in 1980, and the planned capacity of the plant was scaled down from 1 million to 600,000 tons per year. Costain International signed a contract with Krupp Polysius A.G. of the Federal Republic of Germany for civil engineering works for the plant. The main contractor for the plant was Krupp Polysius, and the consulting engineer for the Oman Cement Co. was Basse Sambre E.R.I. of Bel-

gium. Construction was to start early in 1981, with production commencing in the latter part of 1983.

Production from Amiantit Oman's pipe plant, located in the Rusayl industrial zone, was running at 40% capacity during 1980. Amiantit Oman was an Omani company affiliated with the Swiss Eternit Group, with 40% local shareholding. The plant produced four types of pipe, including fiberglass reinforced plastic pipe and cement pipe.

The Ministry of Petroleum and Mineral Resources continued its investigation of Oman's nonoil resources. The northwest Oman mountains have already proved to be heavily mineralized. Scattered podiform chromite deposits, with reserves totaling 5 million to 10 million tons, have been located in the mountains, and were under study. Other mineral occurrences include asbestos (8 million to 10 million tons), coal (10 million tons), iron, lead-zinc, and manganese. Gypsum deposits at Salalah, together with local shale and limestone, were being considered for use in the country's new cement plant. To further explore the country's resources, Japan agreed to undertake a 3-year mineral survey, covering 5,500 square miles in northern Jaalaan and southern Dhofar. The cost was to be covered by the Japanese Government.

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

The mineral industry of the People's Democratic Republic of Yemen (PDRY) consisted of the refining of imported petroleum and the mining of salt. Exports of refined petroleum products accounted for nearly 75% of total exports in 1980, valued at about $250 million.[7] Other income was derived from exports of fish, tobacco, coffee, and salt. The country's major imports were food ($227 million), cement and construction materials ($20 million), crude oil and oil byproducts ($87 million), and industrial raw materials ($41 million). PDRY's balance-of-trade deficit in 1980 amounted to over $200 million. The overall balance of payments was rescued by about $200 million in foreign assistance in the form of soft loans, project assistance, and outright aid grants. Over $20 million in loans was granted by International Development Association, an affiliate of the International Bank for Reconstruction and Development (World Bank), to assist in agricultural development and petroleum exploration. Other foreign assistance was largely from Eastern Europe, mainly the Soviet Union, Bulgaria, and Czechoslovakia.

Infrastructure development continued to be a top priority of the PDRY Government. The country was in the last year of the 1976-80 5-year development plan. During the course of the plan, industrial production rose 167%, fish production rose 137%, building and construction went up 318%, the transportation and communications sector grew 234%, while the agricultural sector grew only 30%. Slightly less than 50% of the productive resources in the economy were under the control of the public sector. The Government planned to fuel new development by promoting these public sector industries. The Government's major project was the construction of two power stations, in Mukalla and Aden, where generation capacity was to be increased by over 200 megawatts and extended into rural areas. The U.S.S.R. was financing both projects.

The Government was also in the process of modernizing port facilities at Aden to accommodate greater transshipments of oil and petroleum products. The renovation was being sponsored by a $14 million loan from the Arab Fund for Economic and Social Development and a supplementary loan from the World Bank. Aden was one of the world's largest oil bunkering facilities prior to the closure of the Suez Canal. New movement through the canal was expected to significantly increase the commercial importance of the port.

The Petroleum and Minerals Board (PMB) offered five onshore areas for bids for petroleum exploration in 1979, all under production-sharing rules. The bids required a minimum of two wells within 3 years. Equity was to be split 40% for the operator, from which costs could be recovered, and 60% for the PMB. Other areas undergoing exploration were the Socotra Island offshore area, where Siebens Oil and Gas Ltd. (Canada) abandoned its first wildcat in 1979. Technoexport of Romania and Azienda Generale Italiani Petroli S.p.A. were exploring offshore areas near the Thalmud coast and the Sayud coast, but no details were available on drilling operations. The World Bank was financing a $9 million petroleum exploration project to aid the Government in evaluating its oil potential. The study involved a 15-month seismic survey to

provide a loose grid of profiles over a large portion of the onshore area. Included in the grant were technical assistance for local Yemeni staff, project management, and data evaluation services. The Government was to pay for $1 million of the total $10 million cost.

Aden's petroleum refinery, originally owned by British Petroleum (BP) until nationalized in 1977, continued to operate at about 35% of its 160,000-barrel-per-day capacity, while still providing over 80% of the country's industrial output. Petroleum products were exported mainly to Africa. Crude oil was imported from Kuwait, Qatar, and the United Arab Emirates at an estimated cost of $100 million. The Government was in the process of adding a butane gas unit to the refinery, which was expected to significantly increase the total value of products. There were no details available on the progress of the project or a startup date for the new unit.

Salt production from the General Salt Organization's facility at Khawr Maksoir continued to provide the country with domestic supplies of salt and an easily marketed export. The plant, located northeast of Aden, was capable of producing 80,000 tons per year of unrefined marine salt from the evaporation of seawater. Salt exports were directed mainly to Africa.

The Government, in cooperation with the Soviet Union, was planning to investigate the feasibility of setting up new industrial projects to be based on local raw materials. Among the projects under consideration were a cement factory and projects to prospect for gold, iron ore, and precious stones. The Government was also interested in establishing a limestone quarry to supply the planned cement factory and possibly a marble quarry for export.

QATAR

The production of hydrocarbons remained the most important economic activity in Qatar, while other oil- and gas-based industries began to diversify the country's industrial base. As part of a major industrialization scheme, Qatar commenced production of petrochemical products, fertilizer, steel, cement, and NGL, all within the past 2 years. The total capital cost of the ventures was expected to exceed $4 billion.[8]

Crude oil was, however, the most important mineral commodity, accounting for 95% of the country's export earnings and over 90% of Government revenues. Oil revenues for 1980 exceeded $5.8 billion, as Qatar increased its official oil price from $27 per barrel at the end of 1979 to $36 per barrel by January 1981. The oil revenues created one of the highest per capita incomes in the world; slightly over $14,000. The country's major exports were crude oil, natural gas, steel, and fertilizer.

Qatar's crude oil production declined 6.7% in 1980, from approximately 506,000 barrels per day in 1979 to 472,000 barrels per day in 1980. Petroleum production was under the control of the Qatar General Petroleum Corp. (QGPC), a wholly Government-owned company. The oil industry was originally owned by two companies: The Qatar Petroleum Co. (QPC), composed of Shell Oil Co. (United States), CFP (France), BP, Standard Oil Co. of New Jersey (United States), Mobil Oil Corp. (United States), and Partex (Portugal) and the Shell Co. of Qatar (SCQ), owned by Royal Dutch/Shell (Netherlands). These foreign companies' assets were nationalized in 1976-77, and the Qatar Petroleum Producing Authority (QPPA) was established as a subsidiary of QGPC to administer these assets. In July 1980, QPPA was merged with QGPC, completing the Government's takeover of the oil industry. QGPC was responsible for oil exploration, oil and gas production, petroleum refining and marketing, and supervision of petroleum projects under construction at the industrial zone of Umm Said.

All onshore oil production in 1980 came from the Dukhan Oilfield, which began producing in 1949. Three main areas, Khatiyah, Fahahil, and Jaliha, make up the field. There were a total of 172 wells in the three areas, 70 of which produce oil, 11 produce natural gas, and the remainder were for water and pressure control. Onshore production for the year averaged 228,000 barrels per day, which represents about 48% of total production.

Offshore production came from three main fields; Idd Al-Shargi, Maydan Mahzam, and Bul Hanine, which began producing in 1964, 1965, and 1973, respectively. Average output from the offshore fields was 244,000 barrels per day in 1980, an 11.5% drop from the 1979 level. Offshore oil was exported through the Halul Island termi-

nal, which had a storage capacity of 6 million barrels. Offshore oil had an average API gravity of 36.6 and a sulfur content of 1.4%, which was slightly lower in quality than onshore oil.

The Bunduq Field, located in the gulf between Qatar and the United Arab Emirates, was exploited by both countries and operated by the Abu Dhabi Marine-Areas Operating Co. The field was shut down in 1979 owing to pressure maintenance problems and did not reopen in 1980.

Further oil exploration by the QGPC in the Dukhan, Bul Hanine, and Maydan Mahzam Fields uncovered additional reserves. A study to evaluate these reserves was being carried out by U.S. Scientific Software and Core Laboratories (both United States). In 1979, 39 new wells were drilled and 3 offshore platforms, including 1 owned by QGPC, were conducting drilling operations.

QGPC's crude oil output was sold under contract to the former shareholders in the company and other Japanese customers. The former shareholders in QPC were entitled to 130,000 barrels per day of crude oil, while Shell of SCQ was entitled to another 145,000 barrels per day. The Japanese contract customers were Mitsubishi (45,000 barrels per day), Sumitomo (30,000 barrels per day), Mitsui (20,000 barrels per day), and Nichimen, Nissho-Iwai and C. Itoh and Co. (10,000 barrels per day each). The remainder was sold on the spot market.

Qatar had one operating refinery in 1980, and planned to construct another by 1983. The National Oil Distribution Co., which was owned by QGPC, operated an 11,000-barrel-per-day refinery at Umm Said. The refinery, brought onstream in 1975, had an initial production capacity of 6,300 barrels per day, but was expanded to meet the local demand for petroleum products. In October 1980, Qatar awarded Technip of France a $138 million contract for the construction of a new 50,000-barrel-per-day refinery, to be located near the existing refinery at Umm Said. The new refinery, to be constructed on a turnkey basis, was to be completed by 1983. It was designed to process oil produced onshore. Included in the contract were storage facilities for intermediate and refined products and new export facilities. The new refinery was expected to satisfy domestic requirements until 1995. Surplus production in the first several years of operation was to be exported.

The production utilization of natural gas was expected to become the fuel to drive Qatar's development in the future. Associated gas was produced from both onshore and offshore oilfields. Onshore gas reserves were estimated at 60 trillion cubic feet. The onshore gas was used for local power generation, and the remainder was transported by pipeline to the Umm Said industrial zone, for use in the Government power generation-water desalinization complex, the Qatar Fertilizer Co. (QAFCO), a new NGL facility, and the Qatar Petrochemical Co. (QAPCO).

In November 1980, Qatar's two fully integrated NGL plants (NGL-1 and NGL-2) were brought onstream. The two plants cost an estimated $738 million, and began production at well below their capacity. Initially, both plants were to utilize Dukhan onshore gas. Meanwhile, the three offshore fields were completing gas gathering and pipeline facilities to make available another 250 million cubic feet per day of associated gas for the plants. A 290-kilometer pipeline was being completed to transport gas from offshore fields to Umm Said. Full rated capacity of NGL-1 and NGL-2 was as follows:

	NGL-1	NGL-2
Propane ---------- tons per day	740	220
Butane ---------- do	470	730
Condensate ---------- do	370	73
Methane-enriched gas million cubic feet per day	140	110
Ethane-enriched gas ---------- do	24	28

The propane, butane, and natural gasoline were for export, while the ethane- and methane-enriched gas was to be used as feedstock for the petrochemical plant. Some methane and residual gas was to be used by the fertilizer plant, the steel mill, and other power stations.

Qatar's future as a world leader in natural gas production was guaranteed by the presence of the Northwest Dome, a large offshore gasfield in the Permian Khuff Formation. Reserve estimates of nonassociated gas range from a conservative 70 trillion cubic feet to 250 trillion cubic feet, which makes this field one of the largest in the world. Qatar was moving cautiously on development, apparently waiting for oil supplies to dwindle and natural gas prices to achieve parity with crude oil. It has, however, invited tenders for a $4 billion gas project to develop the field. Several companies have shown an interest, including Exxon (United States), Mobil, Royal/Dutch Shell, CFP, Wintershall A.G., and BP. The last four have submitted proposals. The

QGPC planned to allow the foreign contractor a 20% equity share in the project, while allowing another foreign firm to handle marketing operations. The project being considered would cost about $4 billion; $1.5 billion for drilling operations and production facilities, $2 billion for an NGL plant, and another $500 million for onshore facilities and related infrastructures. The earliest possible production date was 1983.

The QAPCO petrochemical complex at Umm Said was nearing completion at the end of 1980. QAPCO was owned 84% by QGPC and 15% by Charbonnages de France (CDF)-Chimie. The complex was built by Technip of France under a $200 million turnkey, lump sum contract. The plant was to utilize ethane-enriched gas from NGL-1 and NGL-2 to produce 280,000 tons per year of ethylene, 140,000 tons per year of low-density polyethylene, and 46,000 tons per year of sulfur. Aside from the ethylene unit built by Technip, a $27 million, 50-megawatt power station was supplied by Turbotechnica of Italy. Associated ancillary facilities worth $81 million were supplied by Japan Gasoline Co. The plant was due onstream early in 1981.

QAFCO was producing near capacity by the end of 1980, owing mainly to a halt in fertilizer supplies from Iran and Iraq. QAFCO-1, which came onstream in 1976, had a production capacity of 900 tons per day of ammonia and 1,000 tons per day of urea. QAFCO-2 began producing fertilizer early in 1978, and effectively doubled the capacity of the complex. Ammonia output reached rated capacity near the end of the year to make up for the shortage of supply in the Middle East. QAFCO was located in Umm Said, and was owned by the Government (70%), Norsk Hydro A.S. (Norway) (25%), U.S. Davy Powergas Corp. Ltd. (3%), and Hambros Bank (United Kingdom) (2%). Natural gas feedstock for the plant was derived from the Dukhan Oilfield and residual gases were derived from NGL plants.

The Qatar Steel Co. (QASCO) has become one of the most successful industries in Qatar since its opening in 1978. Output in 1978 was about 85,000 tons, rising to 350,000 tons in 1979, and operating at full capacity of 400,000 tons for all of 1980. The ministeelworks, located in Doha, consisted of a single 400,000-ton-per-year Midrex direct-reduction plant, two 70-ton capacity electric arc furnaces, two 4-strand continuous billet casters, and a tandem rolling mill. Total design capacity was 400,000 tons per year of raw steel and 330,000 tons per year of rolled steel. Iron ore was supplied by Sweden and Brazil, and scrap was from the United States. Approximately 90% of the output of the plant was exported. Steel was exported to Saudi Arabia (42%), the United Arab Emirates (24%), Kuwait (15%), Iraq (8%), and 2% to other countries. QASCO was owned 70% by the Government, 20% by Kobe Steel of Japan, and 10% by Tokyo Boeki, also of Japan. Kobe Steel supplied the casting machines and the rolling mill for the plant, and was also to supply management services to QASCO for its first 8 years of operation.

Cement production from the Qatar National Cement Co. remained well below capacity in 1980, at about 209,000 tons. Capacity of the country's only plant was 1,000 tons per day. This low production level forced Qatar to import over 250,000 tons of cement in 1980. To alleviate the situation, Qatar signed a contract with the Belgian company, IRI, for a new cement works with a capacity of 2,000 tons per day. This amount was expected to meet the country's domestic requirements well into the decade. No specifics on the contract were available.

Table 6.—Qatar: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
Iron and steel metal, all forms	(1)	330,572	--	Saudi Arabia 196,624; Kuwait 74,656; United Arab Emirates 51,853.
Fertilizer materials:				
Urea	347,600	394,600	--	India 182,500; China, mainland 88,100; Malaysia 44,600.
Ammonia	NA	77,100	--	India 61,000; Italy 8,000; Mauritius 6,600.
Petroleum, crude thousand 42-gallon barrels	176,315	182,074	925	Japan 51,877; Netherlands 25,378; France 20,436.

NA Not available.
[1]Unreported quantity valued at $23,850,000 exported in 1978.

Table 7.—Qatar: Imports of mineral commodities

(metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, semimanufactures: Profiles	868	608	19	Italy 274; Hong Kong 92; Japan 35.
Copper metal including alloys, semimanufactures: Tubes	40	195	1	United Kingdom 179; Italy 6.
Iron and steel:				
Ore and concentrate	160,300	496,154	--	Sweden 263,719; Brazil 232,435.
Metal:				
Scrap	96,427	130,827	123,659	Iran 6,734; Kuwait 434.
Semimanufactures	73,374	77,385	734	Japan 33,627; United Kingdom 17,605; West Germany 14,866.
NONMETALS				
Barite	998	2,825	101	India 1,890; Saudi Arabia 666; United Arab Emirates 100.
Cement	246,408	143,836	60	Greece 49,280; Japan 42,807; United Arab Emirates 17,360.
Clay products:				
Refractory including nonclay brick	5,508	1,695	--	Japan 1,200; France 421; United Kingdom 74.
Nonrefractory	27,225	17,686	413	Italy 11,129; United Arab Emirates 1,560; United Kingdom 1,019.
Fertilizer materials, manufactured	71	11	--	All from United Kingdom.
Lime	6,730	452	--	Bahrain 162; India 109; Saudi Arabia 70.
Salt	1,666	1,406	--	Netherlands 1,027; Iran 188; China, mainland 133.
Stone, sand and gravel: Gravel and crushed rock	2,630	1,610	--	Iran 1,046; Lebanon 305; Jordan 203.
Sulfur: Sulfuric acid, oleum	510	460	6	Kuwait 219; Spain 34; United Kingdom 31.
Other: Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	2,730	3,438	--	India 2,394; United Kingdom 471; Belgium-Luxembourg 230.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Fuel oil and lubricants 42-gallon barrels	28,096	46,822	5,792	United Kingdom 20,801; Netherlands 5,434; Belgium-Luxembourg 4,549.
Liquefied petroleum gas ---do---	15,706	8,467	412	United Arab Emirates 2,287; France 1,630; Saudi Arabia 1,442.
Asphalt and bitumen ---do---	2,660	8,085	1,223	Netherlands 3,656; United Kingdom 2,591.

SYRIA

Syria's mineral industry made a significant contribution to the 1980 GDP, estimated at nearly $11 billion.[9] The principal mineral commodities were, in order of decreasing value, petroleum, phosphate rock, cement, fertilizers, and iron and steel. Syria's economy continued to expand in 1980, despite a growing trade deficit and an annual inflation rate of nearly 25%. The GDP grew an estimated 9% in real terms in 1980, twice the rate of 1979. One of the country's main economic problems, its chronic balance-of-trade deficit, continued to worsen, from $1.4 billion in 1979 to $1.9 billion in 1980. Official transfer payments, mostly from other Arab nations, amounted to over $1.6 billion, but still left the country with a small deficit ($244 million) in the overall balance of payments. The Government attempted to narrow the deficit near the end of the year by establishing a two-tier currency exchange rate. The old official rate remained in effect for the major exports (oil, cotton, and phosphates), while all other exports were governed by a new parallel rate determined by market forces. The new structure was intended to promote exports and encourage increased remittances from Syrians working abroad.

Syria's crude oil production in 1980 increased slightly from the 1979 average of 167,000 to 173,000 barrels per day. Production is likely to stabilize at this level for several years, unless additional reserves are located. Recoverable reserves were estimated at 1.6 billion barrels. Five oilfields were being exploited in Syria: Rumeilan, Karachuk, Suweidiyah, Jebisseh, and Alayan.

All of the fields, except Jebisseh, produced low-quality (average API gravity 20°) and high-sulfur (4.5% to 9.5%) crude. Jebisseh produced 40° API low-sulfur crude.

Despite continuing exploration efforts, no substantial new reserves have been discovered in the country. Enhanced secondary and tertiary recovery techniques were thought to be the most likely cause of any increase in recoverable reserves. The state-owned Syrian Petroleum Co. (SPC), which controlled the country's oil industry, was active in exploraton near al-Hasakah. Rompetrol of Romania was also exploring in the northeast of the country. Three U.S. companies, including the Pecten Syria Co., a subsidiary of U.S. Shell, and the Syrian American Oil Co. (SAMOCO) (Coastal States Corp., Houston, Tex., United States) obtained adjacent joint concessions with SPC in central Syria. Deminex of the Federal Republic of Germany joined SAMOCO in the joint concession in 1979. Two other exploration agreements were signed in 1979, one with Marathon Oil Co. (United States) for a 10,000-square-kilometer tract centered around Homs, and the other with Challenger Desert Oil Co. (Chadoil) (Panama) for 17,000 square kilometers south of Palmyra. By yearend 1980, Pecten and SAMOCO had spudded test wells, but no details were available.

Syria's refining industry more than doubled its capacity in 1980, when the Baniyas refinery came onstream late in the year. The older refinery at Homs was built in 1959 and its capacity was upgraded to 38 million barrels per year of crude oil input. Bids were invited during the year for adding additional capacity to the refinery through installation of kerosine and gasoline beneficiation units. These improvements were to raise capacity to 38.5 million barrels per year.

The country's new refinery, at Baniyas, had an annual capacity of 45 million barrels of crude oil. The refinery was built by Industrialexport of Romania, and Romanian personnel began trial runs late in the year. The refinery managed to process 12 million barrels of oil in 1980, which produced 22 tons of butane, 1,300 tons of fuel oil, and 360 tons of naphtha.

Syria's crude oil exports were destined for Western Europe (80%), North America (11%), Eastern Europe (8%), and the Middle East (1%). Most petroleum product exports were delivered to Western Europe. Petroleum trade for the year (exports minus imports) showed an overall surplus of $500 million.

Syria planned to start utilizing its reserves of associated and nonassociated gas. The Syrian Oil Ministry awarded Entrepose of France a $62 million contract for utilization of associated gas from the oilfields of northeast Syria for the manufacture of industrial solvents and condensates. Gas was to be collected from nine gathering stations and pumped through 52 kilometers of pipeline to a main treatment plant. Theoretical input capacity was 660,000 cubic meters of gas per day. The plant was expected to produce 58,000 tons of LPG per year. The project was to be completed by 1982.

The Syrian Government tentatively selected the Soviet Union to aid in its efforts to utilize the country's nonassociated gas reserves. A gas liquefaction plant was to be constructed in al-Jibsah, near the city of al-Hasakah. The project was still in the feasibility study stage in 1980, but the plan was to drill several gas wells, build a pipeline network to a main treatment plant, and construct the necessary ancillary facilities, all by 1986.

The production of phosphate rock in Syria increased about 4% from the 1979 level of 1.27 million to 1.32 million tons in 1980. Phosphate was mined in three main areas: Al-Tadmuria, Al-Shargiya, and Khunayfis, all located just south of Palmyra in central Syria. Phosphate production was under the direction of the state-owned General Co. for Phosphate and Mines. The mines produced an average 66% to 68% TPL rock, most of which was exported. Exports declined slightly, from 1.2 million tons in 1978 to 823,000 tons in 1980. Most of the output was exported to eastern Europe where Romania received 58%; Bulgaria, 9%; Poland, 1.6%; and Yugoslavia, 1.2%. Other exports were to Lebanon (12%), mainland China (7%), and North Korea (9.3%). The remainder (1.9%) went to Western Europe.

For the first time in 1980, domestic deliveries of rock were made to the new phosphate fertilizer facility at Homs. The new plant, built by Industrialexport of Romania, was to produce 150,000 tons per year of phosphoric acid and another 450,000 tons per year of triple superphosphate. The plant began test runs in 1980, and was scheduled for commissioning sometime in 1981.

In addition to new phosphatic fertilizer capacity, a second ammonia-urea plant was

brought onstream in December 1980. The new plant, capable of producing 1,000 tons per day of ammonia and 1,050 tons per day of urea, was built adjacent to the existing facility at Homs. Creusot Loire Enterprises of France was the managing contractor, with Pullman-Kellogg (United States) handling design and engineering for the ammonia unit, and Heurtey Industries responsible for construction of the urea plant. Ammonia feedstock for the plant was naphtha from the country's refinery. The existing facility at Homs was already capable of producing 110,000 tons of nitrogenous fertilizer per year, although production remained well below that capacity. Both plants were under the control of the state-owned General Establishment of Chemical Industries. The new capacity was to eliminate the need for imports and probably provide a surplus for export. Fertilizer was to be exported from the Port of Tartous, where most of the country's phosphates were shipped from, after shipment by rail from the plant.

Syria's cement industry, for several years unable to meet domestic requirements, was to almost double existing capacity by the end of 1981. Ten plants were operating in Syria, with a combined capacity of about 2.3 million tons per year. In 1980, the Chaba Cement Co.'s New Sheikh Said plant, to be located adjacent to the old Sheikh Said plant at Aleppo, came onstream with an annual capacity of 400,000 tons per year. Also in 1980, a new plant at Adra began production at the rate of 150,000 tons per year. The next plant scheduled to start up was a 2-million-ton-per-year plant at Tartous. This new capacity was expected to make Syria a large exporter of cement by 1982.

Iron and steel production in Syria remained fairly stable in 1980, averaging 100,000 tons per year of steel reinforcing bars and galvanized pipe. The General Co. of Iron and Steel Products operated three steel plants at its complex at Hama, using billets imported from Italy, Bulgaria, and the Soviet Union. Feasibility studies evaluating the Zabadani iron ore deposits continued in 1980, but no plans were made to exploit the deposit. Reserves at Zabadani were estimated at 150 million tons of hematite with an iron oxide content of 27% to 30%.

Other minerals produced in Syria include marble, ornamental stone, and gypsum from the Damascus and Latakia areas, asphalt from Oeir ez Zoor, and approximately 80,000 tons of salt.

YEMEN ARAB REPUBLIC

The mineral industry of the Yemen Arab Republic consisted of the mining of rock salt and gypsum and the production of cement. Salt was the only mineral export, and brought in revenues of approximately $65,000[10] in 1980. Exploration for petroleum, copper, and iron ore continued during the year, but there have been no commercial discoveries for any of these commodities.

The Yemeni economy cooled off considerably in 1980, as workers' remittances fell and business activity declined. Foreign aid and remittances from the estimated 1 million Yemenis working abroad were the country's top sources of revenue and the major stimulants of the economy. In 1980, the Yemen Arab Republic's balance of payments slipped to a $2.1 million deficit, for the first time in 5 years. The balance-of-trade deficit was also at an alltime high of $1.7 billion.

Approximately $300 million in foreign aid was channeled into the country from a variety of sources. The United States contributed $12.7 million in grants during the year, with the remainder coming from Saudi Arabia, Kuwait, and other Arab states and Arab development funds. Western Europe and the Soviet Union also contributed some assistance, as well as various agencies of the United Nations. The World Bank approved a $12 million credit to aid in financing local industry through the Industrial Bank of Yemen. The German Democratic Republic and Czechoslovakia also agreed to sponsor some industrial projects including a leather tannery, rural electrification projects, and a marble quarry.

Agriculture remained the largest productive sector of the economy, contributing about 60% to the 1980 GNP of approximately $3.5 billion. Agricultural output consisted mostly of qat, sorghum, millet, barley, corn, wheat, and coffee. Despite its relatively large agricultural sector, the Yemen Arab Republic was a net importer of foodstuffs.

In the minerals sector, production was registered for only two commodities, rock salt and cement, although some gypsum

was probably recovered along with the salt and sold to the cement plant. The Yemen Salt Mining Corp. continued to mine its open pit deposit in the coastal plain adjacent to the Port of Salif. Reserves at the deposit were estimated at 250 million tons of rock salt with an average NaCl content of 98.23%. Rock salt production increased from 50,000 tons in 1979 to 65,000 tons in 1980, as the company was able to market its output more smoothly. Marketing operations had been interrupted from 1972 to 1976 when the mine was undergoing modernization.

A small amount of gypsum was also recovered along with the rock salt at Salif. Gypsum output was sold to the Government-owned cement plant at Banjil, 100 kilometers to the southeast. In 1978, the U.S.S.R., which built the original plant, agreed to extend the plant's capacity to 100,000 tons per year. The new capacity appeared to be onstream in 1980, as cement production increased from 50,000 tons in 1979 to over 81,000 tons in 1980.

In 1979, the Yemen Government awarded a $110 million contract to Ishikawajima-Harima Heavy Industries and Nissho-Iwai (Japan) for the construction of a 500,000-ton-per-year cement plant at Amran, northeast of Sana. No details were available as to the progress of this project.

Petroleum exploration efforts continued in 1980, despite the lack of any commercial discovery. Shell was exploring a 10,000-square-kilometer coastal concession on the Tihana coastal plain, and CFP (France) was also involved in exploration in the Fahda desert region in northern Yemen.

The Yemen Arab Republic imported all of its domestic requirements of petroleum products in 1980. Crude oil supplies were derived from Kuwait and were refined in south Yemen and transported by road to north Yemen. Approximately 5.4 million barrels of products, mostly gasoline, diesel oil, and fuel oil, were imported in this fashion. Another 11,150 tons of liquefied gas was imported from Saudi Arabia. This roundabout route for refined products led to the development of a large smuggling operation bringing refined products in from Saudi Arabia and undercutting the official Government price by as much as two-thirds. A new agreement was signed in 1980 in which Saudi Arabia was to market oil products through Shell and BP directly into north Yemen. In addition to increasing the Government's revenues, lowering the official price for gasoline, and thwarting the smuggling operation, the agreement was also likely to strengthen political and economic ties between Saudi Arabia and the Yemen Arab Republic.

Investigations continued to examine the possibility of mining other minerals in the Yemen Arab Republic. A group of West German and Yemini technicians were examining the possibility of exploiting iron ore deposits in the Sa'dah region. The team was drilling ore samples to determine the quantity and grade of the ore. Copper deposits at Hamurah near Taiz were also under study to determine the size of the deposit. The Government planned to commission an economic feasibility study after the initial tests were completed.

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[1]Supervisory physical scientist, Branch of Foreign Data.
[2]Physical scientist, Branch of Foreign Data.
[3]Where necessary, values have been converted from Bahraini dinars (BD) to U.S. dollars at the rate of BD0.37=US$1.00.
[4]Where necessary, values have been converted from Jordanian dinars (JD) to U.S. dollars at the rate of JD0.298=US$1.00.
[5]Where necessary, values have been converted from Lebanese pounds (LL) to U.S. dollars at the rate of LL3.40=US$1.00.
[6]Where necessary, values have been converted from Omani rials (RO) to U.S. dollars at the rate of RO0.345=US$1.00.
[7]Where necessary, values have been converted from Yemeni dinars (SYD) to U.S. dollars at the rate of SYD0.345=US$1.00.
[8]Where necessary, values have been converted from Qatari rials (QR) to U.S. dollars at the rate of QR3.64=US$1.00.
[9]Where necessary, values have been converted from Syrian pounds (LS) to U.S. dollars at the rate of LS3.29=US$1.00.
[10]Where necessary values have been converted from Yemeni rials (YRls) to U.S. dollars at the rate of YRL4.56=US$1.00.

Table 8.—Yemen Arab Republic: Exports of mineral commodities

(metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
Cement value, thousands	--	$1,140	--	Saudi Arabia $777; Japan $363.
Iron and steel metal, semimanufactures do	$66	$27	--	Republic of Korea $24; Syria $3.
Petroleum refinery products:				
Lubricants do	--	$6	--	All to People's Democratic Republic of Yemen.
Salt	--	210	--	All to Saudi Arabia.
Stone, sand and gravel: Dimension stone, worked value, thousands	$39	$9	--	Do.
Other: Crude do	$7	--		

Table 9.—Yemen Arab Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys:				
Scrap	--	45	--	Hong Kong 29; Saudi Arabia 14; India 2.
Unwrought and semmimanufactures value, thousands	$7,716	$4,126	--	Austria $940; Hong Kong $891; Saudi Arabia $629.
Copper:				
Matte	--	11	--	All from India.
Metal including alloys, all forms value, thousands	$39	$31	--	Italy $11; Belgium-Luxembourg $9; India $3; Saudi Arabia $3.
Iron and steel metal:				
Scrap	190	637	--	Netherlands 455; Sri Lanka 80; Saudi Arabia 62.
Pig iron, ferroalloys, similar materials	--	2,594	--	Italy 1,680; India 451; China, mainland 270.
Steel, primary forms value, thousands	--	$5,472	--	Japan $2,048; China, mainland $1,551; Saudi Arabia $398.
Semimanufactures do	$47,651	$56,278	$131	Japan $14,418; China, mainland $7,230; India $6,329.
Lead metal including alloys:				
Scrap	--	3	--	All from Netherlands.
Unwrought and semimanufactures value, thousands	$3,275	--		
Nickel metal including alloys:				
Scrap	--	95	--	All from West Germany.
Semimanufactures value, thousands	--	$10	--	Saudi Arabia $9; Lebanon $1.
Zinc metal including alloys:				
Scrap	--	90	--	All from Japan.
Unwrought and semimanufactures	(1)	47,683	--	Japan 37,808; Saudi Arabia 2,197; Italy 2,150.
Other: Alkali, alkaline-earth, rare-earth metals value, thousands	$19	$29	--	Italy $13; West Germany $7; Saudi Arabia $6.
NONMETALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones do	NA	$97	--	Italy $39; Denmark $26; West Germany $22.
Boron materials: Oxide and acid	--	415	--	All from West Germany.
Cement value, thousands	NA	$42,705	--	Greece $33,525; Italy $2,963; U.S.S.R. $1,479.
Clay products:				
Refractory including nonclay brick do	NA	$2,773	--	Italy $1,201; Saudi Arabia $363; China, mainland $290.
Nonrefractory do	NA	$12	--	Lebanon $7; India $5.

See footnotes at end of table.

Table 9.—Yemen Arab Republic: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Fertilizer materials:				
Manufactured:				
Nitrogenous value, thousands	$6,055	$6,348	$11	Saudi Arabia $4,098; Greece $1,232; Kuwait $478.
Phosphatic do	--	$547	--	Saudi Arabia $542; West Germany $5.
Potassic	--	9	--	All from Saudi Arabia.
Ammonia	1			
Salt	414	3,215	--	Saudi Arabia 1,119; United Kingdom 1,109; People's Democratic Republic of Yemen 966.
Sodium and potassium compounds, n.e.s.: Caustic soda	(2)	478	1	United Kingdom 231; China, mainland 136; West Germany 81.
Stone, sand and gravel: Dimension stone, worked value, thousands	NA	$754	--	Italy $276; India $147; Greece $83.
Sulfur: Sulfuric acid, oleum	138	3,030	--	West Germany 1,132; Netherlands 818; United Kingdom 723.
Other:				
Crude	(3)	1,052	--	India 605; Italy 240; Saudi Arabia 163.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals value, thousands	--	$2,203	$175	Spain $1,034; Italy $565; West Germany $387.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black do	$75	$219	--	Netherlands $211; West Germany $6; Saudi Arabia $2.
Hydrogen, helium, rare gases	(4)	94	--	West Germany 68; United Kingdom 25; France 1.
Petroleum refinery products:				
Gasoline value, thousands	$5,929	$7,405	--	Saudi Arabia $5,873; Kuwait $816; People's Democratic Republic of Yemen $671.
Kerosine and white spirit do	$8,265	$4,314	--	Saudi Arabia $2,648; Kuwait $1,365; People's Democratic Republic of Yemen $296.
Distillate fuel oil do	$7,350	$8,696	--	Saudi Arabia $5,509; Kuwait $2,276; People's Democratic Republic of Yemen $907.
Residual fuel oil do	--	$445	--	Kuwait $203; Saudi Arabia $171; Netherlands $79.
Lubricants do	$10,106	$8,043	$45	India $2,102; Saudi Arabia $1,046; Poland $908.
Liquefied petroleum gas do	$928	$1,759	--	Saudi Arabia $1,104; People's Democratic Republic of Yemen $559; United Kingdom $66.
Unspecified do	$3,900	$4,806	$126	Saudi Arabia $1,417; Singapore $1,317; Switzerland $518.

NA Not available.
[1]Unreported quantity valued at $3,414,000 imported in 1978; quantity imported in 1979 valued at $8,997,000.
[2]Unreported quantity valued at $23,000 imported in 1978; quantity imported in 1979 valued at $276,000.
[3]Unreported quantity valued at $944,000 imported in 1978; quantity imported in 1979 valued at $36,000.
[4]Unreported quantity valued at $102,000 imported in 1978; quantity imported in 1979 valued at $31,000.

The Mineral Industry of Other Areas of South America

By Pablo Velasco[1]

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ECUADOR

After becoming an oil exporter in 1972, Ecuador experienced a remarkable economic upswing until 1978. However, in 1979 and 1980, a combination of only slight improvements in agricultural output and stagnating petroleum output lowered rates of real gross domestic product (GDP) expansion to 5.3% and 4.3%, respectively. In current prices, the GDP in 1980 was estimated at $11.3 billion.[2] The slowdown in growth is attributable in large part to the low level of petroleum exploration in the 1972-79 period.

Ecuador's production of petroleum declined 4.5% in 1980 compared with that of 1979. The consortium of Corporación Estatal Petrolera Ecuatoriana (CEPE), the State oil company, and Texaco, Inc., operating in Ecuador's eastern jungle region was responsible for nearly all of 1980 production. The volume of total crude petroleum exports from Ecuador dropped from 44.7 million barrels in 1979 to 40 million barrels in 1980, although crude petroleum export revenues rose from $1,032 million in 1979 to $1,294 million in 1980. The latter figure represented 54% of Ecuador's 1980 merchandise exports. Crude oil exports accounted for about 46% of the value of 1979 merchandise exports. The total nonfuel mineral exports in 1980 were valued at less than $1 million.

Falling petroleum production and the low level of investment in petroleum caused the petroleum and mining sector to record negative real growth of about 6.2% during 1980. Nonfuel mineral activity in the country continues to be negligible. The petroleum sector (including refining) contributes 17% to Ecuador's GDP, although the sector employs less than 1% of Ecuador's economically active population. The increase in total export revenues in 1980 was due entirely to the increase in prices that Ecuador obtained for its exports of crude petroleum and petroleum products, which accounted for 62% of total 1980 export revenues.

The United States probably remains the most important purchaser of Ecuadorean exports. According to Ecuadorean statistics, the United States imports 19,000 barrels per day of Ecuadorean crude petroleum and 20,000 barrels per day of fuel oil. Approximately 40% to 50% of Ecuador's exports are destined for the United States. As the Or-

ganization of Petroleum Exporting Countries' smallest member, with reserves of 1 billion to 1.3 billion barrels of oil, Ecuador has decided to use its oil resources to finance other development projects. CEPE envisaged drilling 300 wells between 1980-85 as part of a new exploration program, of which $17 million was spent in 1980. The rapid expansion of spending by the Government and the failure to set aside some funds has created a difficult situation for the exploration of additional oil reserves. Ecuador may become an oil importer by 1985 if oil production continues to fall while domestic consumption grows rapidly.

The most promising areas for further exploration of hydrocarbons are the Amazon region and near the Peruvian border. Exploration for natural gas has been scheduled for the Gulf of Guayaquil. CEPE was planning a $300 million fertilizer project at Pasorja using natural gas from the Amistad Field in the Gulf of Guayaquil. The first phase of the project would be completed in 1984 and would produce 1,000 tons per day of ammonia and 1,000 tons per day of urea. The Amistad natural gas deposit was discovered 10 years ago but has remained undeveloped because of disagreement with U.S. contractors on the most economical use for the gas.

Texaco and CEPE agreed to a $41 million package for 1981 to further develop the country's oil-production capacity. The program will include bringing into production the Yuca, Auca Sur, Yulebra, and Dureno Fields. CEPE will bear 62.5% of the cost and Texaco the remainder.

In a significant departure from long-standing policy, the Government has enacted a variety of price increases, including a trebling of retail gasoline prices from the equivalent of 18 cents per gallon to 60 cents per gallon. Prices for other oil products were increased by a lesser extent. Maintaining the increased prices could pave the way for increased investment in Ecuador's oil industry and may have been a factor in the new agreement with Texaco. Still pending, but ready for implementation, was Texaco's ambitious program for secondary recovery by water flooding at the Shushufindi Oilfield, later to be extended to the Sacha Field. These are Ecuador's largest fields, with output of about 150,000 barrels per day. It is estimated that the Shushufindi Field alone contains more than 300 million barrels of crude oil recoverable by water flooding, and Sacha's prospects are considered to be equally promising. If the estimates are correct, the fields could produce an additional 80,000 barrels per day over a 20-year period.

CEPE was planning to construct a new 75,000-barrel-per-day refinery, scheduled for operation before 1983 or 1984. Government sources have estimated that at least 20% of the gasoline sold in Ecuador, or 5,000 barrels per day, is exported illegally for use in Perú or Colombia. Such a figure exceeded the amount of gasoline Ecuador was required to import in 1980. Given the difference between the domestic price of gasoline and its price in neighboring countries, contraband exports from Ecuador are likely to remain substantial.

While several stimuli exist for the exploration of oil, the nonfuel minerals industry in Ecuador has few incentives. There were a number of small mines producing copper, zinc, gold, and other minerals. The most important was the La Plata copper, lead, and zinc mine, near Santo Domingo de los Colorados in Cotopaxi Province. Earlier this year, Compañía Minera Toachi S.A. announced a $5.2 million investment program at this mine designed to double production of ore over the next 2 years. Financing for the project is coming from the International Bank for Reconstruction & Development (World Bank), a West German bank, and from Toachi's Venezuelan, Finnish, and Peruvian partners. Production from this mine is 100 tons per day of copper, lead, and zinc concentrate. Some gold and silver in concentrate form is also produced. Value of the mine's output is estimated at $8,000 per day.

In mid-1980, Cía. Minera Austral began exploitation of the Peggy Mine (in Azuey Province). Reportedly, current production involves 50 tons per day of copper and zinc concentrate with an estimated value of $5,000 per day.

Ownership of the Portovelo Mine has passed to the Dirección General de Geología y Minas (DGGM), which is in the process of rehabilitating the mine, in part to provide employment opportunities for residents of El Oro Province. Reportedly, the mine was producing 10 tons of concentrate daily. The international call for tenders for the development of the San Bartolomé silver and zinc mine, which has been under discussion for over a year, has not yet been announced. DGGM proceeded with other activities, such as developing reported deposits of iron in

Zamora-Chinchipe Province, doing further development work at the Chaucha copper deposit, and investigating the possibility of exploiting gypsum deposits in Guayas Province. The DGGM had hopes of receiving financing from the Inter American Development Bank and World Bank for some of these activities.

Limited mining activity is likely to continue despite Ecuador's varied geology. The mining sector is not expected to grow in the near future because the outdated mining law "Ley de Fomento Minero," which was approved by the military Government in early 1974, offers few incentives or guarantees to potential investors. Labor and financial problems have driven certain companies close to bankruptcy. Other companies have experienced interruptions in exporting minerals because of accounting and royalty problems with the Ecuadorean Government. Lacking proper encouragement and incentive, the nonfuel minerals industry in Ecuador is not likely to become a meaningful revenue source. Most private sector Ecuadorean and foreign investors interested in Ecuador's virtually unexploited nonfuel mineral sector agree that little development of the sector is likely to occur unless mining legislation and regulations are made more attractive to private investors.

A new, more liberal, mining law has been under discussion within the DGGM and the Ministry of Natural Resources for 4 years. The Ministry approved and sent to the Office of the President a comprehensive new mining law proposal for his approval. Initial reactions from the mining sector have been generally positive, although guarded. The centerpiece of the draft legislation provides for the creation of a public sector mining development corporation, Corporación de Fomento Minero (COFEMIN), as the executive agency for prospecting, exploration, and exploitation activities within the mining sector. The new entity would have the legal authority to develop mines on its own or enter into service or association contracts with private or public sector interests, including foreign mining companies. The draft legislation specifically authorizes the proposed mining development corporation to enter into joint ventures. Under the draft legislation, the role of the DGGM would apparently be restricted somewhat, particularly in exerting control over mining companies that have signed exploitation contracts with the new COFEMIN.

Congressional review of the proposed mining law was expected to be lengthy, with many members of Congress making the legislation more protective of Ecuador's national patrimony and hence less likely to be of interest to prospective foreign investors. Congressional passage of mining legislation will be only the first, although important, step. The proposed mining law would establish the basic framework for the mining sector; it would then be up to the Ministry of Natural Resources to draw up implementing regulations and formally establish the proposed COFEMIN.

Despite approval by the military Government of substantial revisions to Ecuador's hydrocarbons law in May 1978, the Ministry has yet to issue the crucial, implementing regulations, including the model hydrocarbons operating contract that would form the basis for negotiations with prospective foreign investors. Release of the model contract continues to be held up because the Government apparently has not found a formula that is both attractive enough to prospective investors and sufficiently protective of Ecuador's national interests.

Several small companies were mining for nonmetallic minerals, but few have shown any interest in metals because of the lack of detailed information about reserves, the difficulties in obtaining credit, the lack of state support and investment incentives, and the poor infrastructure in the areas where deposits exist. In the future, however, an improvement was expected. A geological metallogenic map of Ecuador developed with technical assistance from Great Britain, the United Nations, and other private firms, was published by the DGGM.

The map identifies around 300 known and possible deposits of minerals within Ecuadorean territory. The metallogenic map and the explanatory report, which includes an alphabetical listing of actual deposits of minerals and indications of some, are in Spanish and are unlikely to appear in English.

Minor exploration continued in the Southern Andes for copper, molybdenum, lead, silver, zinc, phosphorous, and coal. Uranium was also believed to be present in that area. Uranium discoveries would fall under the jurisdiction of the Ecuadorean Atomic Energy Commission. The single most promising development in the mineral industry is the proven copper deposit at Chaucha. A $24 million contract to build a

cement plant was awarded to Allis-Chalmers Canada, Ltd., a unit of Allis-Chalmers Corp. The facility, with a planned capacity of 345,000 tons per year, is to be constructed for Cementos Selvalegre of Quito. Fuller Co. was awarded a $17 million contract by Empresa Industrias Guapán, S.A., to expand to 1,100-ton-per-day-capacity the Guapán cement plant at Azogues by the end of 1980.

Ecuador officials are confident that when present hydroelectric projects become fully operational, hydroelectricity will be the country's predominant source of energy. At this time, hydrocarbons account for only 19% of the total energy reserves compared with 78% for hydroelectric potential. However, at present, oil is providing 54% of the energy and hydroelectricity less than 5%. The state agency, Instituto Ecuatoriano de Electrificacion, has announced that an investment of $4 billion will be needed for the ongoing 1980-85 electricity development plan. New projects should come onstream by 1985 to increase the country's present 658-megawatt capacity to 1,200 megawatts. The major projects include the 550-megawatt Daule-Peripa project, the 1,981-megawatt Naiza project, and the 152-megawatt-capacity Agoyán project.

Table 1.—Other Areas of South America: Production of mineral commodities[1]

Area, commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
ECUADOR[2]					
Cadmium, mine output, metal content, kilograms	462	476	417	[e]480	480
Cement, hydraulic, thousand metric tons	[r]608	[r]623	834	1,099	1,400
Clays: Kaolin, do.	1,138	[r]4,586	3,564	[r e]4,000	4,000
Copper, mine output, metal content, metric tons	[r]300	[r]1,000	800	1,200	[3]1,000
Gas, natural:					
Gross, million cubic feet	11,949	12,290	12,429	13,387	15,000
Marketable, do.	3,713	1,490	[e]1,500	[e]1,600	1,600
Gold, mine output, metal content, troy ounces	11,014	[r]8,124	2,734	3,215	3,500
Gypsum (for cement), metric tons	43,762	[r]41,491	34,209	[r e]35,000	35,000
Lead concentrates, metal content, do.	168	[r]220	220	[e]220	220
Natural gas liquids:					
Natural gasoline, thousand 42-gallon barrels	128	106	79	NA	NA
Liquefied petroleum gas, do.	39	36	721	815	800
Total, do.	167	142	800	NA	NA
Petroleum:					
Crude, do.	68,362	67,002	77,710	78,169	[3]74,714
Refinery products:					
Gasoline, do.	6,079	6,144	7,293	8,119	9,000
Jet fuel, do.	467	537	985	1,107	1,200
Kerosine, do.	1,915	2,381	2,716	2,498	2,500
Distillate fuel oil, do.	2,886	3,234	4,518	5,095	5,600
Residual fuel oil, do.	3,776	6,602	13,018	13,775	14,500
Lubricants, do.	167	194	234	267	300
Other:					
Liquefied petroleum gas, do.	40	192	200	225	250
Unspecified, do.	20	340	317	367	400
Refinery fuel and losses, do.	145	721	1,016	554	1,000
Total, do.	15,495	20,345	30,297	32,007	34,750
Silica, metric tons	NA	10,800	17,011	[r e]13,130	13,200
Silver, mine output, metal content, troy ounces	47,382	[r]57,108	28,617	[r e]44,00	45,000
Stone, sand and gravel:					
Limestone (for cement manufacture), thousand metric tons	880	[r]1,061	1,410	[r e]1,300	1,300
Marble, metric tons	182	[r]2,544	2,789	[r e]2,700	2,800
Sulfur:					
Native, do.	[r]4,364	[r]4,688	4,500	[r e]4,500	4,500
Byproduct:					
From petroleum[e], do.	5,000	5,000	5,000	5,000	5,000
From natural gas[e], do.	3,000	3,000	5,000	5,000	5,000
Total, do.	[r]12,364	[r]12,688	[r e]14,500	[r e]14,500	14,500
Zinc, mine output, metal content, do.	123	1,997	1,340	[r e]1,600	1,600
FRENCH GUIANA					
Gold, mine output, metal content, troy ounces	2,797	4,823	[e]5,000	5,000	5,000
Stone, sand and gravel, metric tons	NA	329,320	325,000	[r e]337,000	330,000

See footnotes at end of table.

Table 1.—Other Areas of South America: Production of mineral commodities[1] —Continued

Area, commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
GUYANA[2]					
Aluminum:					
Bauxite, dry equivalent, gross weight[e] thousand metric tons	2,686	2,731	2,425	2,312	[3]2,077
Alumina do	281	271	250	200	[3]220
Diamond:[4]					
Gem[e] thousand carats	6	7	7	6	4
Industrial[e] do	8	10	10	10	6
Total do	14	17	17	16	[3]10
Gold, mine output, metal content troy ounces	15,656	11,899	15,396	10,593	[3]11,003
PARAGUAY					
Cement, hydraulic thousand metric tons	155	200	166	155	[3]177
Clays:					
Kaolin metric tons	[e]14,000	[e]22,000	35,380	40,000	[3]50,000
Other thousand metric tons	1,100	1,320	1,518	1,870	[3]2,200
Gypsum metric tons	16,000	14,000	9,000	11,000	[3]12,000
Lime do	31,863	[r]53,300	38,554	33,000	[3]55,000
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	480	648	805	662	[3]906
Jet fuel do	53	69	75	94	[3]101
Kerosine do	127	145	151	132	[3]120
Distillate fuel oil do	899	1,390	1,710	1,705	[3]1,931
Residual fuel oil do	287	333	371	384	[3]371
Liquefied petroleum gas do	39	45	46	58	[3]52
Refinery fuel and losses do	92	358	467	731	800
Total do	1,977	2,988	3,625	3,766	4,281
Pigments, mineral, natural: Ocher metric tons	120	120	150	200	[3]200
Sand including glass sand thousand metric tons	981	1,401	1,900	2,300	[3]2,600
Stone:					
Dimension do	130	144	197	224	[3]258
Crushed and broken:					
Limestone (for cement and lime) do	277	415	370	300	[3]350
Other do	2,380	3,500	5,140	5,450	[3]6,400
Talc, soapstone, pyrophyllite metric tons	140	130	160	210	250
SURINAME					
Aluminum:					
Bauxite, gross weight thousand metric tons	[r]4,613	[r]4,805	5,188	5,010	[3]4,643
Alumina do	1,162	[r]1,172	1,310	1,325	[3]1,422
Metal, primary[5] do	45	58	55	64	[3]46
Cement, hydraulic do	[e]50	48	60	62	[3]69
Clays:					
Common metric tons	NA	116,000	[e]115,000	[e]115,000	115,000
Kaolin[5] do	--	2,500	2,500	2,500	2,500
Gold, mine output, metal content troy ounces	39	376	NA	NA	NA
Sand and gravel:					
Sand, common thousand metric tons	([6])	NA	160	150	155
Gravel metric tons	[r]65,000	[r]94,500	75,000	67,500	75,000
Stone, crushed and broken thousand metric tons	137	75	40	50	[3]72
URUGUAY					
Aluminum, secondary metric tons	31	52	45	69	[3]35
Barite do	--	50	33	25	35
Cement, hydraulic thousand metric tons	676	682	674	687	[3]262
Clays, type not specified metric tons	425,704	336,009	338,890	340,000	NA
Coke, gashouse do	11,685	[e]11,685	[e]11,685	[e]11,685	12,000
Corundum do	381	421	223	[e]227	225
Feldspar do	1,145	1,625	2,572	[e]2,700	2,600
Fluorspar do	50	75	113	[e]77	85
Gas, manufactured million cubic feet	753	[e]750	[e]750	[e]750	760
Gem stones, semiprecious:					
Agate metric tons	35	802	184	[e]200	190
Amethyst do	2	[e]2	32	[e]33	30
Iron and steel:					
Ferroalloys: Electric furnace ferrosilicon do	260	105	--	--	NA
Steel, crude do	15,400	17,200	8,700	17,000	14,000
Semimanufactures do	34,841	47,265	43,898	93,449	[3]71,759

See footnotes at end of table.

Table 1.—Other Areas of South America: Production of mineral commodities[1] —Continued

Area, commodity, unit of measure	1976	1977	1978	1979[p]	1980[e]
URUGUAY —Continued					
Lime thousand metric tons	70	70	85	81	80
Petroleum refinery products:					
Gasoline thousand 42-gallon barrels	2,051	1,940	2,211	2,136	[3]1,953
Jet fuel do	263	269	219	312	[3]234
Kerosine do	1,326	1,199	1,243	1,119	[3]1,032
Distillate fuel oil do	3,365	3,355	3,812	3,413	[3]3,510
Residual fuel oil do	5,062	5,170	4,993	5,137	[3]5,780
Lubricants do	1	37	39	49	[3]45
Other:					
Liquefied petroleum gas do	384	397	431	417	[3]447
Unspecified do	58	287	335	397	[3]349
Refinery fuel and losses do	229	228	235	([7])	[3]43
Total do	12,739	12,882	13,518	12,980	[3]13,393
Sand and gravel:					
Sand:					
Common thousand metric tons	1,649	1,885	2,077	[e]2,200	2,300
Glass metric tons	--	2,210	1,698	[e]1,700	1,750
Gravel thousand metric tons	864	[e]865	341	[e]400	450
Stone:					
Dimension do	95	13	87	[e]80	85
Crushed and broken:					
Alum schist metric tons	1,441	2,483	11,392	[e,r]10,000	10,500
Dolomite thousand metric tons	34	95	110	[e]120	130
Limestone do	859	1,192	1,190	[e]1,100	1,200
Marble do	4	4	5	[e]5	5
Marl metric tons	8,769	900	11,553	[e]10,000	10,500
Quartz do	7,024	200	([6])	([6])	([6])
Other (including ballast) thousand metric tons	1,115	1,758	1,488	[e]1,500	1,500
Sulfur, elemental, byproduct[e] metric tons	2,200	2,200	2,200	[e]2,200	2,200
Talc, soapstone, pyrophyllite do	1,268	1,659	1,724	[e]1,800	1,800

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Includes data available through Sept. 1, 1981.

[2]In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) undoubtedly is also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Gem and industrial diamond production is estimated based upon reported total production.

[5]Data represent exports.

[6]Less than 1/2 unit.

[7]Refinery fuel apparently included with products for sale, mainly residual fuel oil and liquefied petroleum gas.

Table 2.—Ecuador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
Aluminum metal including alloys, semimanufactures	--	11	--	All to Colombia.
Copper:				
Ore and concentrate	1,972	--		
Metal including alloys, scrap	NA	40	--	All to Colombia.
Iron and steel metal, semimanufactures:				
Universals, plates, sheets	--	1,213	--	Chile 1,200; Colombia 13.
Other ores and concentrates	72	60	--	All to Belgium-Luxembourg.
Petroleum:				
Crude thousand 42-gallon barrels	5,217	46,554	16,533	Panama 15,683; Chile 4,228; Canada 4,108.
Refinery products:				
Gasoline do	--	33	--	All to Peru.
Residual fuel oil do	713	8,201	5,738	Mexico 1,362; Netherlands Antilles 602; Panama 223.
Unspecified do	21	--		
Stone: Dimension, worked	--	3	--	All to Venezuela.
Tungsten ore and concentrate	NA	8,000	--	All to Sweden.

NA Not available.

Table 3.—Ecuador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	NA	437	306	United Kingdom 128.
Metal including alloys:				
Unwrought	2,380	1,820	--	Canada 1,172; Venezuela 498; West Germany 150.
Semimanufactures	3,339	5,142	342	Japan 2,925; Austria 520; France 460.
Arsenic:				
Trioxide, pentoxide, acid	NA	3	--	All from Sweden.
Elemental	NA	14	2	West Germany 7; Canada 5.
Chromium:				
Oxides and hydroxides	NA	17	9	West Germany 8.
Metal including alloys, all forms	--	2	2	
Cobalt oxides and hydroxides value	NA	$1,000	--	All from West Germany.
Copper metal including alloys:				
Unwrought	4	1	--	All from United Kingdom.
Semimanufactures	1,856	2,647	120	Chile 1,467; Peru 708; Italy 68.
Iron and steel metal:				
Scrap value	--	$27,000	--	NA.
Pig iron, ferroalloys, similar materials	--	470	259	Colombia 107; Japan 40.
Steel, primary forms	147,955	94,637	19,780	Finland 45,560; West Germany 20,423; Chile 4,163.
Semimanufactures:				
Bars, rods, angles, shapes, sections	72,111	80,530	14,493	Republic of South Africa 29,826; Japan 18,871.
Universals, plates, sheets	96,408	84,412	2,262	Japan 67,292; Chile 8,280; France 2,085.
Hoop and strip	2,050	2,870	70	Japan 2,388; Belgium-Luxembourg 191; West Germany 189.
Rails and accessories	538	6	3	Spain 3.
Wire	1,533	2,022	15	Japan 1,412; Republic of South Africa 189; Chile 146.
Tubes, pipes, fittings	19,244	35,863	3,579	Japan 26,180; Argentina 2,151.
Castings and forgings, rough	222	287	272	Peru 10.
Lead:				
Oxides	NA	677	--	Mexico 672; Peru 5.
Metal including alloys:				
Unwrought including scrap	614	840	58	Peru 630; Panama 130.
Semimanufactures	59	53	15	Peru 15; West Germany 8.
Magnesium metal including alloys, all forms	--	42	2	Japan 38; West Germany 2.
Manganese oxides	NA	1,234	184	Mexico 540; Colombia 510.
Mercury value	NA	$6,000	$3,000	West Germany $2,000.
Nickel metal including alloys, semimanufactures	27	29	7	Netherlands 15; Finland 4.
Platinum-group metals including alloys, unwrought and partly wrought value	$48,000	$77,000	$4,000	United Kingdom $52,000; Switzerland $21,000.
Silver metal including alloys, unwrought and partly wrought do	$347,000	$194,000	$10,000	West Germany $181,000.
Tin:				
Oxides	NA	1	--	All from Mexico.
Metal including alloys, all forms	22	41	3	Bolivia 17; West Germany 7; Peru 7.
Titanium oxides and hydroxides	NA	802	118	United Kingdom 235; Mexico 181; West Germany 119.
Tungsten:				
Ores and concentrates value	--	$2,000	$2,000	
Metal including alloys, all forms	NA	60	53	Brazil 7.
Zinc:				
Oxide	NA	265	12	Peru 95; Mexico 51; Venezuela 47.
Metal including alloys:				
Scrap	--	34	14	Peru 15; Colombia 5.
Blue powder	--	4	4	
Unwrought	1,224	1,897	37	Peru 1,498; Canada 353.
Semimanufactures	104	58	31	Italy 14; Belgium-Luxembourg 7; West Germany 5.
Other:				
Oxides, hydroxides, peroxides	[1]2,454	--		
Metals:				
Alkali, alkaline-earth, rare-earth metals	NA	1	1	
Pyrophoric alloys value	NA	$1,000	--	All from West Germany.
Base metals including alloys, all forms	--	2	2	

See footnotes at end of table.

Table 3.—Ecuador: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum, etc	478	550	77	Mexico 450; West Germany 18.
Artificial corundum	NA	22	--	Brazil 16; West Germany 2.
Grinding and polishing wheels and stones	238	200	33	Japan 35; Brazil 32; Italy 29.
Asbestos	4,417	6,184	1	Canada 4,849; Australia 1,290; China, mainland 5.
Barite and witherite	NA	1,174	891	Peru 273; Colombia 10.
Boron materials:				
Crude natural borates	NA	5	--	Italy 3; West Germany 1.
Oxides and acid	NA	24	10	France 12; West Germany 1.
Cement	310,669	315,199	42	Colombia 132,516; Mexico 60,012; Peru 52,740.
Chalk	NA	1,083	--	Belgium-Luxembourg 895; France 188.
Clays and clay products:				
Crude	2,172	3,675	2,335	United Kingdom 880; Peru 247.
Products:				
Refractory including nonclay brick	6,280	3,991	1,273	Colombia 1,711; West Germany 494.
Nonrefractory	--	165	16	Colombia 148; Japan 1.
Diamond, industrial ---- value	$229,000	$538,000	--	All from Belgium-Luxembourg.
Feldspar and fluorspar	NA	30	30	
Fertilizer materials:				
Crude: Phosphatic	--	28	28	
Manufactured:				
Nitrogenous	37,088	73,951	10,327	Yugoslavia 23,718; Republic of Korea 10,000; Netherlands 9,788.
Phosphatic	15,735	9,207	9,200	Italy 6; Colombia 1.
Potassic	11,499	11,396	9,196	West Germany 1,714; Japan 236; Switzerland 235.
Other including mixed	1,366	12,575	6,438	West Germany 5,666; Norway 405.
Ammonia	NA	152	3	Colombia 52; Netherlands 49; West Germany 16.
Graphite:				
Natural	NA	4	(2)	United Kingdom 2; West Germany 2.
Artificial	NA	1	1	
Gypsum and plasters	--	1,814	813	Peru 1,001.
Lime	NA	600	--	All from Peru.
Magnesite	NA	1	--	All from West Germany.
Mica, all forms	--	15	15	
Pigments, mineral:				
Natural, crude	NA	125	(2)	Spain 77; Belgium-Luxembourg 45; China, mainland 2.
Iron oxides, processed	NA	206	21	West Germany 91; Argentina 30; Spain 30.
Precious and semiprecious stones, natural and synthetic ---- value	NA	$80,000	$1,000	Switzerland $67,000; Belgium-Luxembourg $9,000.
Salt	--	3	--	All from West Germany.
Sodium and potassium compounds, n.e.s	NA	9,404	5,252	Bulgaria 1,350; West Germany 563; Colombia 550.
Stone, sand and gravel	892	1,138	149	Italy 789; Colombia 130.
Sulfur:				
Elemental:				
Other than colloidal	2,228	41	11	Belgium-Luxembourg 20; Colombia 5; West Germany 5.
Colloidal	NA	2,572	67	Venezuela 2,500.
Sulfur dioxide ---- value	NA	$3,000	--	All from Brazil.
Sulfuric acid, including oleum	NA	247	3	Netherlands 208; West Germany 30.
Talc, steatite, soapstone	NA	943	484	China, mainland 250; Austria 40; India 20.
Other:				
Crude	1,865	25	21	United Kingdom 2; Japan 1.
Slag, dross, and similar waste, not metal-bearing, from iron and steel manufacture	--	16	16	
Oxides and hydroxides of magnesium, strontium, barium	NA	58	50	France 2; West Germany 2; Israel 2; Netherlands 2.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	15,904	3,702	505	Colombia 3,197.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	--	363	174	Colombia 189.

See footnotes at end of table.

Table 3.—Ecuador: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Carbon black	NA	1,395	103	Colombia 1,193; Venezuela 52.
Coal, anthracite and bituminous	15	51	7	Belgium-Luxembourg 36; Japan 8.
Coke and semicoke	1,206	148	--	All from Colombia.
Hydrogen, helium, rare gases	NA	24	11	Mexico 11.
Petroleum:				
Crude and partly refined 42-gallon barrels	297	223	223	
Refinery products:				
Gasoline do	--	17	17	
Distillate fuel oil do	--	2,686	2,499	Netherlands 82; West Germany 60; China, mainland 37.
Lubricants do	167,146	241,605	23,037	Netherlands Antilles 109,333; Venezuela 107,807.
Mineral jelly and wax do	47,204	42,907	2,534	China, mainland 8,421; West Germany 8,114; Japan 6,941.
Unspecified do	8,701	10,703	6,363	Colombia 4,109; United Kingdom 140.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	565	232	189	United Kingdom 41; West Germany 1; Netherlands 1.

NA Not available.
[1]Total of oxides of metals; detail not reported.
[2]Less than 1/2 unit.

FRENCH GUIANA

The mineral industry of French Guiana remains insignificant in the Nation's economy, except for minor quantities of gold, crushed rock, sand and gravel, and clay domestically consumed.

Gold has been mined in small quantities since 1950, when foreign interests were allowed to enter the country to engage in geological and mining explorations. Gold placer mining has been practiced in French Guiana ever since. The local Government of French Guiana is actively engaged in promoting the mineral development of this overseas department. Direct French investment in mineral-related enterprises would be preferred but failing that, the country would welcome foreign participation to some extent. Bauxite deposits in the Kaw Mountains in southern French Guiana appeared to be the only promising mineral resource upon which to base a mineral economy. However, the low grade and small reserves made this prospect unattractive to foreign investors. Zones of Government reserves with petroleum potential are excluded from foreign control.

Gold production increased in 1980 in response to higher world prices. Major export trade partners were 78% United States, 11% France, and 5% Martinique; major import partners were 49% France, 10% United States, and 3% Trinidad and Tobago. French Guiana's future development prospects depend upon programs of the French Government for building the infrastructure necessary for sustained industrial development.

The total labor force amounted to 18,000, of which 50% is engaged in services, 21% in construction, 18% in agriculture, 8% in transportation, and 3% in information. Organized labor constituted about 7% of the labor force.

Table 4.—French Guiana: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Destinations, 1978	
			United States	Other (principal)
Aluminum metal including alloys, semimanufactures value	--	$2,000	--	All to Suriname.
Iron and steel metal:				
Scrap	--	18	--	All to Brazil.
Semimanufactures: Hoop and strip	--	1	1	
Petroleum refinery products, unspecified 42-gallon barrels	--	280	154	Suriname 98; Martinique 28.

Table 5.—French Guiana: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	191	116	11	France 29; Suriname 29; Italy 20.
Copper metal including alloys, semimanufactures	--	16	--	France 13; Belgium-Luxembourg 3.
Iron and steel metal:				
Steel, primary forms	--	18	--	All from France.
Semimanufactures:				
Bars, rods, angles, shapes, sections	2,780	1,583	--	France 1,435; Belgium-Luxembourg 148.
Universals, plates, sheets	1,145	1,404	--	All from France.
Hoop and strip	--	2	--	Do.
Wire	--	42	--	France 40; Guadeloupe 1.
Tubes, pipes, fittings	5,381	563	--	France 560; West Germany 2; United Kingdom 1.
Castings and forgings, rough	--	68	--	All from France.
Lead metal including alloys, semimanufactures	--	2	--	Mainly from France.
Nickel metal including alloys, semimanufactures	--	2	1	France 1.
Silver metal including alloys, partly wrought value	--	$1,000	--	All from France.
Zinc:				
Oxides	--	1	--	Do.
Metal including alloys, semimanufactures	--	1	--	Do.
Other: Alkali, alkaline-earth, rare-earth metals	--	5	--	Do.
NONMETALS				
Abrasives, n.e.s.:				
Natural	--	13	--	Do.
Artificial corundum	--	4	--	Do.
Grinding and polishing wheels and stones	--	3	--	Do.
Barite	--	21	21	
Cement	22,862	25,399	--	Haiti 9,200; France 6,215; Cuba 4,000.
Clay products:				
Refractory including nonclay brick	50	137	--	All from France.
Nonrefractory	1,396	1,217	--	France 588; Italy 454; West Germany 119.
Fertilizer materials:				
Manufactured:				
Nitrogenous	--	125	15	France 100; West Germany 10.
Phosphatic	--	25	--	All from France.
Potassic	--	14	--	Belgium-Luxembourg 10; France 4.
Other including mixed	773	472	--	France 377; Suriname 75; Martinique 20.
Ammonia	--	2	--	All from France.
Lime	NA	161	--	Do.
Precious and semiprecious stones value	--	$52,000	--	Brazil $51,000; Colombia $1,000.
Salt	--	234	--	France 147; West Germany 87.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	--	12	--	All from France.
Stone, sand and gravel	--	181	--	France 177; Italy 3.
Sulfuric acid, oleum	--	10	--	All from France.

See footnotes at end of table.

Table 5.—French Guiana: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1977	1978	Sources, 1978	
			United States	Other (principal)
NONMETALS —Continued				
Other:				
Crude	--	452	--	France 447; Netherlands 5.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals	--	576	--	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Coke and semicoke	--	21	--	Do.
Hydrogen, helium, rare gases	--	127	--	Do.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	234,846	227,443	--	Trinidad and Tobago 226,253; Netherlands Antilles 1,190.
Kerosine ---do---	53,266	90,667	--	Trinidad and Tobago 87,265; Netherlands Antilles 3,317.
Distillate fuel oil ---do---	528,698	513,240	--	Trinidad and Tobago 492,763; Netherlands Antilles 20,470.
Lubricants ---do---	8,568	10,339	406	Netherlands Antilles 4,466; Trinidad and Tobago 3,696; France 1,491.
Liquefied petroleum gas ---do---	17,191	19,917	--	Trinidad and Tobago 14,651; Netherlands Antilles 3,503; Venezuela 1,334.
Unspecified ---do---	22,932	15,484	63	Netherlands Antilles 14,665; France 742.

NA Not available.

GUYANA

The Cooperative Republic of Guyana's production of bauxite and its processing into alumina accounts for just under 20% of GDP estimated at $520 million[3] and about 40% of total foreign exchange earnings. In addition to being one of the world's significant producers of bauxite, Guyana supplies 85% of the world's calcined bauxite (for specific use in the refractory industry) and 80% of chemical-grade bauxite. Bauxite and alumina output for 1980 totaled 1.8 million tons, 200,000 tons short of the target of 2.0 million tons. Output of calcined bauxite was an 800,000-ton target (601,000 tons); metal and chemical-grade, 979,000-ton target (900,000 tons); and alumina, 211,000-ton target (300,000 tons). The Guyanese economy continued the downward trend in 1980. The real growth rate was minus 2.0% compared with minus 3.7% in 1979.

Total export earnings of the bauxite industry were $190 million, 14% below the projected level but significantly above the 1979 amount of $128 million. The increase in earnings over 1979 was largely due to higher world market prices.

The production shortfall derived in part from a lack of functioning equipment, both in the mines and in the bauxite and alumina plants at Linden, and a continued exodus of skilled and managerial personnel dissatisfied with the overly politicized approach the Government has used to staff and run the industry. Green Construction Co., a U.S. firm, expects to complete half of its job of removal of overburden at some of the Linden mines shortly and to finish its operation by November 1, 1981, 8 months ahead of schedule.

The Guyána Government held preliminary discussions with the World Bank in January 1980 for assistance in funding Guyana's multibillion dollar hydropower and aluminum smelter projects. Because of increased energy cost, the Guyana Government has estimated petroleum fuel impact costs for 1980 in the vicinity of $10 million against $8 million in 1979; in the absence of any hydropower development, this figure was expected to reach $171 million by 1990. Given the World Bank's interest in the development of alternative energy sources, the World Bank was expected to contribute the major portion of the financing required for the hydropower project. The proposed installation would include a 1,200-foot-long dam in the Upper Mazaruni area in the northwest region of the country. Govern-

ment officials indicated that the World Bank considered the 750-megawatt hydropower project to be technically viable and financially sound. The revised cost estimate is between $700 million and $750 million, depending on the ultimate size of the installation.

Foreign participation in the financing of the $700 million aluminum smelter, with a projected capacity of 150,000 tons per year, was expected to be forthcoming since the conditions necessary for such a project are already present in the country. These conditions include the availability of bauxite reserves and a 320,000-ton-per-year-capacity alumina plant, a skilled work force of 7,000, and availability of water, land, and the cheap power that would be provided by the proposed hydropower project.

The Guyana Government has affirmed the need for a partner for the smelter that would bring needed technology. A 1985 target date was set for the smelter and hydropower projects. The proposals were under study by the World Bank. The state-owned Bauxite Industrial Development Co. (BIDCO) signed an agreement with Brazil's Companhia Vale Do Rio Doce for the supply of bauxite and alumina amounting to $70 million. BIDCO has scheduled deliveries to begin in July 1981 until 1984.

Owing to the doubling in the average price of gold in 1980, Guyana, a land with potential in gold and other precious metals, was taking measures to step up its gold production and thus benefit from the price rise. Legislation was enacted for establishing a National Gold Board, which is to become the country's sole trader in gold. Production of gold in 1980 increased 4%.

An agreement was signed between the Cooperative Republic of Guyana and the Canadian-based Republic Mining Co., which is expected to employ mechanical means for gold extraction.

Another Canadian mining company, the Marudi Mining, Ltd., an associate of the Norman Mines, was negotiating with the Guyana Government to carry out gold mining operations in the Rupununi region. The Guyana Geology and Mines Commission proposed to start two small state-owned gold mining operations as part of its current mining program. Local mining engineers were expected to work closely with foreign mining concerns to acquire valuable knowledge of large-scale mining operations.

Another important development in the minerals field was the signature of an initial agreement between the Guyana Government and the state-owned Cogema of France, giving the latter nonexclusive rights to explore for uranium in Guyana. Deposits with particularly high potential are believed to exist close to the Venezuelan border, where monazite and euxenite mineralization has been found. Grundstofftechnik of Essen, in the Federal Republic of Germany, was also reported to have signed an agreement to explore for uranium.

BIDCO has carried out various investigations during the last few years, which have indicated that there are sufficient reserves of kaolin ores associated with bauxite deposits in the country to sustain a large-scale kaolin mining operation. BIDCO has decided to commission a consulting firm to carry out a comprehensive preliminary feasibility study of the project. Bids for this work have already been closed but no announcement has been made.

An investment code was published in 1979 to define the role of private investment in the economy, which is recognized by the Government to comprise the private, cooperative, and public sectors. The code permits foreign investment in manufacturing (whether for local market or for export), oil exploration, and tourism (subject to arrangements worked out with the Government), fishing, forestry, and mining (except for bauxite mining and again subject to arrangements to be worked out with the Government). Within these areas, foreign investment is permitted individually or in association with one or more Guyanese firms. While the code does not give a guarantee that investments will be protected, whether licensed or registered, the Guyanese Government's attitude is that foreign investment generally would be nationalized as long as it operates within the Government's development framework. The Government has indicated that it would be reviewing existing legislation and treating various aspects of foreign investment and consolidating it into an investment act, which would contain implementing regulations for the code.

No legal regulations exist on technology transfer, payments for royalties or trademarks, or profit repatriation. An agreement between the United States and Guyana guaranteeing investments exists and forms the basis for the Overseas Private Investment Corp.'s insurance coverage for inconvertibility, expropriation, and war risks. Many of the U.S. investments in Guyana have coverage.

Table 6.—Guyana: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum:				
Alumina:				
Hydrated	12,981	NA	NA	NA.
Unhydrated	234,222	NA	NA	NA.
Bauxite:				
Calcined	578,338	NA	NA	NA.
Other	998,000	NA	NA	NA.
Total	1,576,338	1,713,846	630,933	Canada 507,038; West Germany 88,964; Venezuela 84,868.
Copper metal including alloys:				
Scrap	--	48	NA	United Kingdom 47.
Unwrought	--	28	--	All to United Kingdom.
Gold metal including alloys, unwrought and partly wrought, troy ounces	39	NA	NA	NA.
Iron and steel metal, semimanufactures	530	200	--	Barbados 178; Antigua 2.
Lead metal including alloys:				
Scrap	58	128	76	United Kingdom 52.
Unwrought	--	40	30	Trinidad and Tobago 10.
Semimanufactures	28	31	--	All to Trinidad and Tobago.
NONMETALS				
Clays and clay products:				
Crude	--	6	--	Yugoslavia 5.
Products: Nonrefractory	203	--		
Diamond, gem, unset, carats	10,999	(1)		
Precious and semiprecious stones except diamond, value	--	$14,000	--	All to Belgium-Luxembourg.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, 42-gallon barrels	26,988	2,363	--	All to Trinidad and Tobago.
Distillate fuel oil, do.	21,530	2,984	119	Bunker 2,820; Trinidad and Tobago 45.
Residual fuel oil, do.	--	3,164	--	All for bunkers.
Lubricants, do.	49	42	--	Bunkers 21; Suriname 7.

NA Not available.
[1]Quantity not reported: exports valued at $577,000 in 1978 and $407,000 in 1979 (principally to Belgium-Luxembourg).

Table 7.—Guyana: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	r447	624	66	United Kingdom 540; West Germany 13.
Copper metal including alloys, all forms	r96	3,598	3,532	United Kingdom 36; Netherlands 28.
Iron and steel metal:r				
Pig iron, cast iron, ferroalloys	20	123	--	All from United Kingdom.
Steel, primary forms	1,521	1,131	3	Japan 1,085; United Kingdom 42.
Semimanufactures:				
Bars, rods, angles, shapes, sections	67,545	60,290	79	United Kingdom 57,783; West Germany 1,643.
Universals, plates, sheets	503,509	510,337	12,656	United Kingdom 495,241; Japan 1,518.
Hoop and strip	71	130	21	United Kingdom 80; Japan 26.
Rails and accessories	18,499	90	82	United Kingdom 6; West Germany 2.
Wire	425,497	1,245	4	United Kingdom 953; West Germany 286.
Tubes, pipes, fittings	1,014	77,582	1,697	Netherlands 72,822; United Kingdom 2,736.
Castings and forgings, rough	108	1	--	All from United Kingdom.

See footnotes at end of table.

Table 7.—Guyana: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Lead:				
Oxides	231	4	--	Trinidad and Tobago 3.
Metal including alloys, all forms	127	16	1	United Kingdom 13; Trinidad and Tobago 2.
Nickel: Matte, speiss, similar material	--	10,008	--	All from United Kingdom.
Silver metal including alloys, unwrought and partly wrought value	$17,000	$10,000	$1,000	United Kingdom $8,000.
Tin metal including alloys, all forms	12	1	--	All from United Kingdom.
Titanium oxides	--	46	--	France 45; United Kingdom 1.
Zinc:				
Oxides	3	13	--	All from United Kingdom.
Metal including alloys, all forms	72	7	5	Japan 2.
NONMETALS				
Abrasives, n.e.s.:				
Natural	10	5	1	United Kingdom 4.
Grinding and polishing wheels and stones	4	6	3	United Kingdom 3.
Cement	37,142	78,844	1	Cuba 41,608; North Korea 32,719.
Clays and clay products:				
Crude	144	25	25	
Products including nonclay brick value, thousands	$969	$1,735	$518	United Kingdom $1,136.
Fertilizer materials:				
Crude	--	33	30	NA.
Manufactured:				
Nitrogenous	24,027	29,913	4,998	Trinidad and Tobago 24,861; Netherlands Antilles 25.
Phosphatic	2,447	7,055	7,004	Netherlands 51.
Potassic	661	700	700	
Other including mixed	53	217,030	1	United Kingdom 217,029.
Ammonia	23	38	4	United Kingdom 22; Netherlands 6.
Graphite, natural	--	1	(1)	United Kingdom 1.
Gypsum and plasters	47	67	9	United Kingdom 58.
Lime	4,359	5,810	2,180	United Kingdom 3,630.
Pigments, mineral:				
Natural, crude	--	112	--	All from United Kingdom.
Iron oxides, processed	--	8	--	United Kingdom 4; West Germany 3.
Salt	4,090	5,109	137	Canada 4,957; United Kingdom 15.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	24,086	31,906	31,798	United Kingdom 47; West Germany 32.
Caustic potash	6	2	--	All from United Kingdom.
Soda ash	30	106	8	United Kingdom 80; France 17.
Stone, sand and gravel	16,101	18,463	261	Bahamas 17,433; Barbados 605.
Sulfur:				
Elemental	3	2	--	West Germany 1; United Kingdom 1.
Sulfuric acid, oleum	43	1,064	1,017	United Kingdom 38; Trinidad and Tobago 9.
Talc, steatite, soapstone	40	36	16	Italy 10; Norway 10.
Other: Building materials of asphalt, asbestos, and fiber cements, and unfired nonmetals	7	23	1	United Kingdom 22.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,391	2,321	18	Netherlands Antilles 1,560; Trinidad and Tobago 741.
Carbon black	1	1	--	All from United Kingdom.
Coal, anthracite and bituminous	8	3	--	All from China, mainland.
Coke and semicoke	20,186	13	--	All from United Kingdom.
Hydrogen, helium, rare gases	55	98	70	Canada 20; United Kingdom 6; West Germany 2.
Petroleum refinery products:				
Gasoline thousand 42-gallon barrels	341	357	--	Trinidad and Tobago 354; Netherlands Antilles 3.
Kerosine do	176	215	--	Trinidad and Tobago 197; Netherlands Antilles 18.
Distillate fuel oil do	1,005	1,093	--	Trinidad and Tobago 1,082; Netherlands Antilles 11.
Residual fuel oil do	3,005	1,699	--	Mainly from Trinidad and Tobago.
Lubricants do	58	56	6	Jamaica 17; Netherlands Antilles 17.
Liquefied petroleum gas do	75	68	(1)	Trinidad and Tobago 49; Venezuela 14.

See footnotes at end of table.

Table 7.—Guyana: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum refinery products —Continued				
Mineral jelly and wax thousand 42-gallon barrels	2	1	(1)	Mainly from United Kingdom.
Unspecified ——do——	--	45	(1)	United Kingdom 40; Netherlands Antilles 2.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	131	16	1	United Kingdom 14.

[r]Revised. NA Not available.
[1]Less than 1/2 unit.

PARAGUAY

Paraguay continued to enjoy, for the fourth consecutive year, one of the most rapid rates of economic growth in Latin America. The country's continued prosperity was based on the expansion of agricultural production for export and the beginning of the exploitation of the hydroelectric potential of the Paraná River. The combination of these factors set off an unprecedented boom in the country. In real terms the economy in 1980 grew by 10% with an estimated GDP of over $2 billion.[4] This growth rate was expected to continue providing the basis for further industrial development.

Construction of the second dam on the Paraná River was expected to begin within a year, and given present plans, Paraguay will have the benefit of significant amounts of hydroelectric plant construction through the 1990's. However, a major economic problem was the high rate of inflation, which reached 28% in 1979 but dropped to 22% in 1980, owing mainly to the considerable inflows of funds for the massive hydroelectric projects under construction and an increase in the cost of oil imports.

The minerals industry of Paraguay continued to be limited to the production of a number of nonmetallic mineral commodities, including common clays, cement, gypsum, common sand, limestone for cement, and crushed and rough stone. Mineral production was at a record high level in 1980. The volume of production of nonmetallic minerals expanded 14% to 12.1 million tons in 1980 compared with that of 1979, and the value of nonmetallics produced increased 31% to $88.1 million. The value of petroleum refinery products increased to $52.5 million. New annual records were established for each nonmetallic mineral.

To meet the growing demand of the construction industry, particularly that arising from dam construction, the expansion of the cement industry was given considerable official priority. Feasibility studies were being undertaken in 1980 for the increase in capacity of the country's only cement plant, operated by the state-owned Industria Nacional del Cemento from the present 200,000 metric tons per year to around 720,000 metric tons per year. A second cement plant, with a capacity of 600,000 metric tons per year, was to be constructed with Brazilian financial aid. Shipments of cement increased 13% to 177,000 metric tons in 1980 compared with that of 1979, and the value of cement went up 39% to $18 million.

Another priority project in 1980 was the establishment of a 100,000-ton-per-year steel mill, Paraguay's first, at Villa Hayes north of Asunción, which has been under consideration for several years; the mill is currently under construction, while bidding for equipment is underway. Aceros del Paraguay, S.A. (ACEPAR), is a joint venture formed to operate Paraguay's first steel mill. It will concentrate its production on satisfying local demand and will be dependent upon iron ore imported from the Urucum iron ore deposits in the Brazilian State of Mato Grosso. The smelter will be fueled by locally produced "carbón vegetal" or charcoal.

ACEPAR is owned 39% by a Brazilian consortium, Empresa Brasileña, F.L.M., 1% by Técnica Nacionál de Engenharía S.A., the Brazilian firm responsible for the construction and erection of the facility, and 60% by Siderúrgia Paraguaya, a Paraguayan enterprise that is wholly owned by the Government and administered by the Ministry of Defense. The official estimated cost of the project is $81.0 million. Cost increases and delays, however, are expected to push

the final cost to approximately $100 million. Carteira do Comercio Exterior do Banco de Brasil (CACEX) was expected to provide $77 million with the remaining amount to be provided by ACEPAR or other financial sources.

Deposits of iron ore and manganese occur in Paraguay, as do other minerals including uranium and copper. Exploration for uranium and other minerals was carried out in 1980 by the U.S. company, Teton Exploration and Drilling Co., over an area of 25 million hectares in western Paraguay. Anschutz Corp., also of the United States, and two Asian electrical utility companies, have discovered uranium at an undisclosed site in Paraguay. The Taiwan Power Co., the Korean Electric Co., and Anschutz Corp. have jointly sponsored the prospecting project. Further drilling is being carried out to determine the extent of the deposits and the commercial feasibility of mining them. The exploration program has cost between $6 to $7 million per year of which the U.S. company was providing 50% and the Asian utilities, 25% each.

Paraguay's energy requirements and its future growth are dependent on three binational hydroelectric projects, all stemming from the vast hydroelectric potential of the Paraná River, which were at various phases of planning and construction. The three projects are Itaipú, Yaciretá-Apipé, and Corpus, with a total planned capacity of 21,650 megawatts.

The most important hydroelectric project is a Paraguayan—Brazilian joint venture at Itaipú, claimed to be the world's largest. The first generating unit, which is to begin operating in 1983, with full capacity of 12,600 megawatts, was scheduled to be installed by 1988. The cost of the Itaipú project, being met mainly by Brazil, is estimated at $12.7 billion. By the time it is finished, the project will cost an estimated $17 billion. Although energy generation at Itaipú will begin in 1983, significant earnings from the sale of power to Brazil will not be seen until Itaipú approaches full output a few years later. Brazil wants and needs all the power that Itaipú will generate, and the agreement signed between the two countries is heavily biased toward the sale of Paraguay's 50% share of electricity to Brazil and against its use domestically.

Also to be constructed, in conjunction with Argentina, is the 3,700-megawatt Yacyretá-Apipé station, which was to be completed by yearend 1980. The Comisión Mixta Paraguayo-Argentina del Río Paraná decided to build the Corpus hydroelectric plant in the Itacus area with a total capacity of 4,000 megawatts.

Oil exploration continued in different parts of the country by both local and U.S. companies. Texaco-Marathon has a drilling program within a 1.6-million-hectare concession area along the Paraguayan River frontier with Brazil, and Chaco Exploration Co. spent about $6 million in 1980 on test drilling in the Chaco Boreal region of northwestern Paraguay where significant resources of oil and natural gas have been reported.

SURINAME

Suriname continued to be dependent on bauxite as the most important industry of the economy. Bauxite, alumina, and aluminum accounted for 80% to 90% of all exports and for about 30% of GDP estimated at $890 million.[5] The economy is also heavily dependent on inflows of foreign aid from the Netherlands. Expansion of real GDP has slowed down from the 6% per year growth recorded in 1976 and 1977 to about a 4% per year rate in the past 3 years.

Bauxite production in 1980 was about 5 million tons and output of alumina and aluminum was about 1.3 million tons and 46,000 tons, respectively. Suriname Aluminum Co., a wholly owned subsidiary of the Aluminum Co. of America (Alcoa), and Billiton Maatschappij Suriname, N.V., owned by Royal/Dutch Shell, accounted for the major part of this output. Since bauxite reserves in existing concession areas near Parabaribo are expected to approach exhaustion within 15 years, negotiations were underway with the joint venture companies for the exploitation of new reserves in the western part of the country. This western development project will involve the construction of two large dams to produce more than 500 megawatts of hydroelectricity, a new industrial and agricultural port city at Apoera, a 72-kilometer railroad for surface transport of bauxite deposits in the Bakhuys Mountains to the river port of Apoera, and an optional smelter.

It appears now that more emphasis will be placed on the development of the Kabale-

bo hydroelectric project, contingent upon Suriname's ability to obtain international financing. The Bakhuys bauxite exploitation apparently has been shelved, at least for the near future. The Kabalebo project, sheduled for completion in 7 years, together with the existing Afobaka hydroelectric dam, would provide 90% of Suriname's projected power requirements.

Billiton B.V. of the Netherlands has announced that it has awarded a contract to Bos Kalis International for the removal of 13 million cubic meters of overburden from a site near Billiton's current mining operation. The overburden removal will prepare bauxite for mining during the second half of the 1980's. Bauxite production from Billiton's Suriname operations was about 2 million tons per year.

The Suriname Government established the Bauxite Institute to monitor the production of the ore and the performance of the local industry. Considering recent trends in bauxite production worldwide, the Government felt that the formation of such an institute was of vital importance to the country's main foreign exchange earner.

The French concern, Cogema, undertook some prospecting for uranium during 1980. It was also reported that two companies were studying plans to develop gold deposits.

In September 1980, the Government of Suriname and Gulf Oil Co. signed an agreement outlining the terms and conditions under which Gulf would begin offshore oil exploration, and if appropriate, exploitation. Some of the important elements of the agreement are: (1) The Government of Suriname is to form a state oil company which will be responsible for oil exploration throughout Suriname and its economic zone. (2) Gulf will act as a contractor for the state oil company for the exploration and exploitation of oil in a 13,000-square-kilometer sector off the western segment of Suriname's northern coast. (3) Percentage breakdown of the production-sharing agreement (considered by Gulf to be commensurate with that offered by other oil-producing nations). (4) Gulf expects to complete surveys and test drillings in 1981 and begin exploitation in 1982. Gulf's plan is to invest $8 million in exploration, but that figure would increase substantially if initial activity produces positive results. (5) Gulf has agreed to explore the feasibility of constructing a refinery in Suriname. (6) Gulf's concession covers only a part of Suriname's offshore area, running for 150 kilometers along the coast with a width of almost 100 kilometers.

In May 1980, an economic policy statement was released by the new Government known as the new "Crash Program" to be completed in 2 years. The program is largely devoted to basic projects involving construction of bridges across two major rivers, beginning of the Kabalebo hydroelectric project, establishing a "Bauxite Bureau" to create an effective mineral policy, controlling the Nation's resources by passing new mining and land allocation laws, reforming the Investment Law, and establishing a Government Center for Industrial Development and Export Promotion. All of these programs were either underway or in the planning stage.

About 65% of Suriname's oil imports were used for electricity production and only 10% for transportation. When Kabalebo's first planned electric generators come online, the country's foreign oil requirements will be cut to a very low level. The new Government State Oil Corp. was negotiating with other foreign oil companies interested in acquiring concessions.

URUGUAY

Uruguay's economic growth in 1979 was the highest for over two decades. However, the growth rate in 1980 slowed down to 4.5%, giving a real GDP estimated at $7.6 billion.[6] An exchange rate policy in combination with the import liberalization program, and the anti-inflationary measures have placed local industry under growing pressure, reflected in the sharp fall in the sector's growth in 1980. A further deceleration in overall economic growth was expected in 1981 from the anti-inflation policy. The 1980 inflation rate was 43%, only a little over half the inflation rate recorded in 1979 and lower than the 50% projection. Inflation in 1981 was expected to be in the 35% to 40% range.

Uruguay's trade deficit increased again in 1980, reaching, according to preliminary estimates, around $570 million compared with $418 million in 1979. Increased expenditure on imported oil, which increased about 45% to $420 million in 1980, accounted for over 25% of total imports compared

with $217 million in 1979.

In 1980, Uruguay managed to overcome the disruption of its supply of crude petroleum from Iraq. Despite this interruption in shipments from Iraq late in 1980, imports of crude petroleum increased 13% to 13.4 million barrels compared with 11.7 million barrels imported in 1979. Almost 50% of Uruguay's needs were imported from Venezuela and Nigeria.

The mineral industry in Uruguay is of minor significance for the country and the world economy. Mining activity was concentrated in the nonmetallic sector of which cement and other construction materials were the most important. Owing to the factors mentioned above, production of cement decreased 62% in 1980 compared with 1979 production. Fuller Co. of the United States, through its South African subsidiary, received a multimillion dollar contract from the Administración Nacionál de Combustibles, Alcohol, y Portland for expansion of the existing 400-ton-per-day cement plant at Paysandú to 900 tons per day. All the equipment was to be supplied from South Africa by Fuller-GATX (Pty), Ltd., with the plant scheduled to be in operation in 1980.

Brazil's major private sector steel group, Gerdau, announced late in 1980, that it had reached an agreement to take over two steel plants in Uruguay. Gerdau plans to pay $12.4 million for ALIS, S.A., and Laminadora Industrial, S.A. (LAISA) of Montevideo, which together produce about 30% of the rolled steel consumed in Uruguay.

Gerdau planned to operate both plants through a holding company based in the southern Brazilian city of Porto Alegre. ALIS is the raw steelmaker and is the major ingot steel producer in Uruguay. LAISA has rolling mills producing rods, bars, and sections and is the country's major nonflat product plant with an output of 12,000 tons per year. Gerdau hoped to double production to take a larger share of the Uruguayan market and provide for exports. Gerdau was awaiting authorization from the Banco Central before finalizing the mergers.

Production of rolled steel products in 1980 decreased 23% compared with that of 1979 production.

Consumption of petroleum products fell by 10% in 1980 compared with 1979, owing to a drop in thermal electricity production resulting from a greater availability of hydroelectric power from Salto Grande and other hydroelectric plants. To minimize consumption of petroleum in the country, the Government of Uruguay approved, in October 1980, a plan for rationalization of energy use. The plan establishes immediate measures as well as medium- and long-term procedures to improve the use of energy from traditional sources and to develop new sources of energy. Some of these procedures are: (1) The Ministry of Industry and Energy (MIE) will study the results of petroleum exploration carried out and the reinterpretation of seismic studies of the Continental Shelf to assist Government agencies in studying the possibility of new explorations. (2) MIE will study agreements for electrical interconnections with Argentina and Brazil. (3) MIE will coordinate the exploration for and the use of coal, peat, and shale. (4) MIE will study the possibilities of joint exploitation with Brazil of the coal deposits along their common border. (5) MIE, through the Geological Institute, plans to negotiate with a French company a contract for uranium exploration. (6) MIE will accelerate the study of alternative sources of energy (solar, biomass, and geothermal) and plans for their utilization.

Sharply rising expenditures for imported oil have led to increased attention being paid to domestic energy supplies in recent years. A number of hydroelectric facilities were under construction, the largest of which is the 1,980-megawatt Salto Grande project on the Río Uruguay, a binational venture with Argentina. An agreement was reached between the two countries calling for feasibility studies for a new hydroelectric plant on the Río Uruguay, downstream from the Salto Grande project. Work on the Palmar hydroelectric project on the Río Negro was progressing on schedule, and in December 1981, the first turbine is scheduled for operations. The 330-megawatt Palmar hydroelectric plant is being built with Brazilian assistance at a total estimated cost of $220 million.

Oil exploration continued during 1980 and the Minister of Industry and Energy was expecting financial assistance with seismic research. An agreement was made with Argentina regarding the construction of an experimental nuclear reactor. Argentina also will supply natural gas through pipelines beginning in 1983, which will also contribute to a reduction in the country's dependence on imported oil.

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[1]Physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Ecuadorean sucres (S/) to U.S. dollars at the rate of S/25=US$1.00.

[3]Where necessary, values have been converted from Guyanese dollars (G$) to U.S. dollars at the rate of G$2.55=US$1.00.

[4]Where necessary, values have been converted from the Paraguayan guarani (G) to U.S. dollars at the rate of G126=US$1.00.

[5]Where necessary, values have been converted from the Surinamese guilder (Sur. f.) to U.S. dollars at the rate of Sur. f.1.78876=US$1.00.

[6]Where necessary, values have been converted from the Uruguayan peso (Ur$) to U.S. dollars at the rate of Ur$9.10=US$1.00.

The Mineral Industry of Other South Pacific Islands

By Charlie Wyche[1]

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FIJI

In 1980, gold, silver, and pit and quarry construction materials were the principal minerals produced in the Dominion of Fiji. The combined value of these minerals totaled some $7.2 million,[2] over 85% of all mineral production. Production of cement, sand and gravel, and quarry products continued to increase, but gold and silver production from Fiji's only operating mine declined slightly from the previous year's level.

Mineral exploration has been carried out by U.S., Australian, British, Canadian, West German, and South African companies since the early 1960's, and a high level of activity was maintained throughout 1980. At the end of 1980, some 40 mineral prospecting licenses covering over 4,300 square kilometers were in force, and 19 applications were under consideration by the Mineral Resources Department. Total expenditures by mining companies on land base projects exceeded $6 million in 1980.

As in previous years, most activity was on the main island of Viti Levu. However, there was an increased interest in previously less well prospected islands. In the Namosi District of southeast Viti Levu, exploration and development work have indicated several occurrences of porphyry copper, molybdenum, and gold mineralization. In south and central Viti Levu, geological mapping and geophysical surveys were completed over areas containing small massive sulfide copper-zinc deposits. In western Viti Levu, gold mineralization was reported, and systematic sampling was commenced, but the presence of economic mineralization has yet to be demonstrated.

At Mount Kasi on Vanua Levu, where gold has been mined, the diamond drilling program was completed. Again, no major new ore extensions were reported, but based on the drilling results and on detailed

Table 1.—Other South Pacific Islands: Production of mineral commodities[1]

Area, commodity, and unit of measure	1976	1977	1978	1979[p]	1980[e]
FIJI					
Cement, hydraulic—metric tons	69,000	77,488	82,000	96,000	[2]84,000
Gold, mine output, metal content—troy ounces	65,757	49,067	28,065	30,768	27,900
Lime[3]—metric tons	2,666	1,997	835	1,308	1,400
Silver, mine output, metal content—troy ounces	19,773	14,695	10,415	10,656	10,200
Stone, sand and gravel:					
Coral sand for cement manufacture—metric tons	78,316	107,861	88,104	120,000	120,000
River sand for cement manufacture—do.	52,783	41,494	59,515	70,683	70,700
River sand and gravel, n.e.s—cubic meters	851,762	562,898	310,041	367,700	370,000
Quarried stone—do.	181,683	107,698	[e]120,000	205,071	200,000
Tellurium metal—kilograms	2,446	[e]12,250	[e]22,700	[e]22,700	11,350
KIRIBATI[4]					
Phosphate rock (all produced on Banaba Island, formerly Ocean Island)—thousand metric tons	417	446	465	420	--
NAURU[4]					
Phosphate rock[5]—do.	755	1,146	1,999	1,828	[2]2,087
NEW CALEDONIA					
Cement—metric tons	54,180	50,605	55,000	60,000	60,000
Chromium: Chromite, gross weight—do.	9,537	8,310	8,229	12,407	12,600
Cobalt, mine output:					
Content by analysis[6]—do.	[r]3,204	[r]3,127	1,798	2,219	2,239
Recovered[e 7]—do.	80	110	155	210	180
Giobertite—do.	653	--	--	--	--
Nickel:					
Ore:					
Gross weight—thousand metric tons	[r]5,958	[r]5,892	3,349	4,300	4,340
Metal content[8]—metric tons	[r]119,795	[r]116,795	67,156	82,886	[2]83,644
Metallurgical products:					
Ferronickel:					
Gross weight—do.	156,766	119,357	77,908	123,306	132,300
Metal content (nickel plus cobalt)—do.	[r]38,142	28,283	19,889	30,373	[2]32,580
Nickel matte:					
Gross weight—do.	31,076	30,071	22,521	16,282	20,550
Metal content (nickel plus cobalt)—do.	23,759	23,038	17,103	12,262	[2]15,479
Stone, sand and gravel:					
Stone:					
Crude (unspecified)—cubic meters	38,000	[r]34,700	26,000	104,051	NA
Crushed—do.	108,000	[r]80,500	166,000	73,435	NA
Sand—do.	63,000	[r]70,000	63,000	67,797	NA
Silica (for metallurgical use)—do.	28,862	[r]40,800	12,405	15,683	NA
PAPUA NEW GUINEA[4]					
Copper, mine output, metal content—metric tons	175,806	182,291	198,603	170,788	[2]146,813
Gold, mine output, metal content—troy ounces	668,014	739,730	751,265	630,496	[2]451,707
Silver, mine output, metal content—do.	1,451,000	1,522,750	1,680,800	1,428,480	[2]1,180,000
SOLOMON ISLANDS[4]					
Gold—do.	600	372	[e]400	1,076	[2]1,093
Silver—do.	NA	NA	NA	115	[2]161
VANUATU[3]					
Manganese:					
Ore—metric tons	217,000	153,000	133,000	112,400	--
Concentrate—do.	[9]35,075	[10]23,040	[10]20,732	[10]10,544	--

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through July 15, 1981.

[2]Reported figure.

[3]Produced from an unreported amount of domestically quarried limestone.

[4]In addition to the commodities listed, crude construction materials (common clays, sand and gravel, and stone) are produced, but output is not reported quantitatively and available general information is inadequate to make reliable estimates of output levels.

[5]Data represent exports.

[6]Total cobalt content of nickel ores mined based on average nickel-cobalt ratio in metallurgical products for 1880-1972.

[7]Cobalt actually recovered for use as cobalt; excludes cobalt content of nickel-cobalt alloys, and/or included in ferronickel.

[8]Nickel-cobalt content of ore produced as reported by New Caledonia's Mines Service. Of the total, about 97.323% is nickel; the balance is cobalt (based on average nickel-cobalt ratio in metallurgical products for 1880-1972).

[9]Data represent Japanese imports.

[10]Data revised to represent actual production rather than Japanese imports, as given in previous editions.

surveys in the area, some followup work was planned.

Four offshore oil exploration licenses were in force to U.S. oil companies in areas of the Fiji Platform known as Bligh Water, Yasawa, Lomaiviti, and Great Sea Reef. The Mineral Resources Department's research vessel *RV Bulikula* was used on charter to carry out detailed surveys in Bligh Water. This work, together with further interpretation of geophysical and geochemical data, defined targets for a drilling program that commenced in mid-1980 by Chevron Overseas Inc.

COMMODITY REVIEW

Metals.—*Copper.*—Copper Resource Ltd. (a subsidiary of Conzinc Riotinto of Australia Ltd.) delivered a full report to the Fijian Government on the economics of the Namosi copper deposits on Viti Levu. In its report, the company informed the Government that the deposits were currently uneconomical, in view of the copper content of the deposits and the current forecast for copper prices. As a result of the prefeasibility study's findings, the Ventures (also including Anglo Pacific Ltd., subsidiary of Australian Anglo American Ltd., and Preussag Fiji Ltd. of the West German Preussag Group) decided against undertaking a full feasibility study. The deposit remains a significant potential resource, and the companies have indicated to the Fijian Government that they wish to retain their special prospecting license. The study, which included diamond drilling and geological sampling, indicated an ore body of 450 million tons at 0.4% to 0.5% copper. The study also indicated that the deposit was minable by open pit, with a waste-to-ore ratio of approximately 2:1.

Gold.—Emperor Gold Mining Co. Ltd., the wholly owned operating subsidiary of Emperor Mines Ltd., mined sulfotelluride gold ores at Vatukoula on the north coast of Viti Levu. During 1980, the company employed about 700 men to mine and treat 238,000 tons of ore and recovered 27,900 troy ounces of gold and 10,200 troy ounces of silver. The greatly improved gold prices enabled the company to report a small operating profit of $7,000, following losses of over $2 million in 1978-79. Emperor Mining was planning to increase gold ore output and intensify its prospecting for new gold in areas along the Tavua Basin.

Emperor Mining made a complete recalculation of reserves tonnages and grade during the year, and on June 30, the total underground reserves using a cutoff grade of 6.12 grams per ton stood at 1.1 million tons of measured ore at an average grade of 9.95 grams per ton. Indicated ore reserves totaled 187,000 tons at an average grade of 8.57 grams per ton. Indicated reserves in the open cut amounted to 71,000 tons at an average grade of 6.89 grams per ton.

The recent high gold prices stimulated interest in the industry in Fiji and a number of companies have taken out prospecting licenses. Pacific Energy and Minerals Co. of Golden, Colo., started exploring the inland areas of Viti Levu near Vatukoula gold mine. Consolidated Gold Fields of Australia (CGFA) began prospecting on the islands of Kadavu and Ono, where gold traces have been reported.

Nonmetals.—Emperor Gold Mines continued to produce burnt lime from its limestone quarry at Tau but did not report production. The number of sand and gravel licenses granted continued to increase, although procedures providing for determination of compensation for damages to fishing grounds remained in force.

Fiji Industries Ltd. dredged 186,000 tons of coral sand from Suva Harbor and 56,000 tons of common sand and gravel from the Rewa River and tributaries in 1980. Some 470,000 tons of quarried stone was also recovered.

The Government's Mineral Resources Division continued evaluating a phosphate clay deposit on the island of Tuvutha, where 1.5 million tons of 10% P_2O_5 was reported.

Mineral Fuels.—*Petroleum.*—Mapco Ltd. and Pacific Energy & Minerals Ltd. began drilling for oil in Fiji. Drilling began in the Bligh Waters in April, and other areas scheduled for drilling include Yasawa, Lomaiviti, and Great Sea Reef.

Table 2.—Fiji Islands: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, all forms	2	7	--	Wallis and Futuna Islands 5; Australia 1; New Zealand 1.
Copper metal including alloys:				
Waste and scrap	284	234	--	All to Australia.
Unwrought and semimanufactures	21	10	--	Mainly to Taiwan.
Gold, nonmonetary:				
Bullion, troy ounces	25,866	29,069	--	All to Australia.
Sweepings and waste, kilograms	--	3	--	Do.
Metal including alloys, unwrought and wrought, troy ounces	--	622	--	Australia 621; Vanuatu 1.
Iron and steel metal:				
Waste and scrap	1,389	1,192	--	New Zealand 1,074; Australia 118.
Steel, primary forms	30	10	--	Wallis and Futuna Islands 6; Australia 3; Tuvalu 1.
Semimanufactures	648	[1]959	--	Tonga 353; Vanuatu 156; Wallis and Futuna Islands 67.
Lead metal including alloys:				
Waste and scrap	96	82	--	Republic of Korea 46; Singapore 30; Australia 6.
Unwrought and semimanufactures, value	$2,627	$7,727	--	All to Australia.
Silver:				
Bullion, troy ounces	9,900	10,915	--	Australia 10,901; Vanuatu 14.
Waste and sweepings, kilograms	--	9	--	All to Singapore.
Metal including alloys, unwrought and wrought, value	--	$11,127	--	All to Australia.
Titanium oxides, kilograms	1,466	--		
Zinc metal including alloys:				
Unwrought, do	40	47	--	All to Tuvalu.
Semimanufactures, value	$1,002	$41,124	--	Mainly to New Zealand.
Other:				
Ash and residue containing nonferrous metals	145	65	--	All to Australia.
Oxides, hydroxides, peroxides, kilograms	20	--		
NONMETALS				
Abrasives, n.e.s.:				
Grinding and polishing wheels and stones, value	$1,027	$541	--	New Zealand $460; Tonga $51.
Natural and artificial powders and grains, do	$159	$24	--	All to Tuvalu.
Cement	9,664	3,310	1,106	Wallis and Futuna Islands 1,309.
Chalk and earth colors, kilograms	130	100	--	All to Australia.
Clays and clay products including all refractory brick:				
Crude clays, do	140	315	--	All to Tonga.
Products:				
Refractory including nonclay brick, value	--	$1,934	--	All to New Zealand.
Nonrefractory, do	$17,313	$19,632	--	Tonga $14,419; Western Samoa $3,967; Tuvalu $1,246.
Fertilizer materials, manufactured, kilograms	3,529	150	--	All to Tuvalu.
Gypsum and plaster, do	50	--		
Lime	10	--		
Precious and semiprecious stone, value	--	$80,885	--	Australia $37,685; United Kingdom $35,790; New Caledonia $7,410.
Salt	1	8	([2])	Gilbert Islands 6; Wallis and Futuna Islands 1.
Sodium and potassium compounds, n.e.s.:				
Caustic soda, kilograms	8	--		
Stone, sand and gravel:				
Dimension stone, worked, value	$723	$967	--	All to New Caledonia.
Gravel and crushed rock, kilograms	2,325	940	840	Australia 100.
Sand excluding metal-bearing	17	5	([2])	Mainly to Tuvalu.
Sulfur: Sulfuric acid, value	$521	$125	--	All to Tuvalu.
Other:				
Oxides, hydroxides, peroxides, do	$49,808	$2,916	--	Australia $1,997; Western Samoa $857.
Slag, dross, ash, not metal-bearing:				
From iron and steel manufacture	2	5	3	Australia 2.
Other, kilograms	332	21,476	--	All to Australia.
Building materials of asphalt, asbestos and fiber cements, and unfired nonmetals, value	$2,362	--		
Unspecified, do	$307,883	$60,524	$34,486	West Germany $25,568.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	8	--		
Carbon black and retort carbon, kilograms	2	--		

See footnotes at end of table.

Table 2.—Fiji Islands: Exports and reexports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Destinations, 1979	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS —Continued				
Hydrogen, nitrogen, rare gases _ kilograms	3,027	3,466	--	Gilbert Islands 2,095; Tuvalu 1,241.
Petroleum refinery products:				
Gasoline:				
Motor _ thousand 42-gallon barrels	143	134	--	Western Samoa 53; Vanuatu 23; Tuvalu 21.
Aviation _ do	13	14	--	Vanuatu 5; Gilbert Islands 3.
Kerosine _ do	37	40	--	Western Samoa 15; Cook Islands 13.
Jet fuel _ do	565	660	--	Bunkers 563; Tonga 26; Australia 24; Vanuatu 14.
Distillate fuel oil _ do	392	338	--	Bunkers 159; Western Samoa 70; Norfolk Island 30.
Residual fuel oil _ do	78	49	--	All for bunkers.
Lubricants _ do	5	1	--	Mainly for bunkers.
Other:				
Liquefied petroleum gas _ do	1	1	--	Mainly to Western Samoa.
Naphtha _ do	6	3	--	Western Samoa 2.
Unspecified _ do	(2)	(2)	--	Mainly to Tuvalu.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals _ value	$1,004	--		

[1]Excludes an unreported quantity valued at $236,838 in 1979.
[2]Less than 1/2 unit.

Table 3.—Fiji Islands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS				
Aluminum metal including alloys, unwrought and semimanufactures	312	448	(1)	New Zealand 234; Australia 157.
Copper metal including alloys:				
Waste and scrap	7	10	--	New Zealand 6; Australia 4.
Unwrought and semimanufactures	57	93	1	Australia 30; United Kingdom 27; New Zealand 23.
Gold metal including alloys, unwrought and wrought _ troy ounces	1,005	1,517	--	Australia 626; Singapore 453; Canada 327.
Iron and steel metal:				
Waste and scrap _ kilograms	4,208	68	--	All from New Zealand.
Pig iron, cast iron, similar materials	67	68	--	Hong Kong 62; Australia 5.
Ferroalloys	5	6	--	Mainly from Australia.
Steel, primary forms	12,966	9,025	14	New Zealand 3,003; West Germany 2,943; Australia 2,758.
Semimanufactures:				
Bars, rods, angles, shapes, sections	6,155	7,399	10	New Zealand 4,027; Hong Kong 1,325; Australia 1,076.
Universals, plates, sheets	12,447	10,295	7	Australia 4,705; New Zealand 3,147; Hong Kong 938.
Hoop and strip	411	363	--	Australia 267; New Zealand 69; Hong Kong 27.
Rails and accessories _ value	$47,737	$146,897	--	Australia $142,039; New Zealand $4,043; Hong Kong $815.
Wire	1,678	2,229	(1)	Australia 1,636; New Zealand 422; Taiwan 62.
Tubes, pipes, fittings[2]	2,317	4,066	76	Australia 2,541; New Zealand 495; Taiwan 412.
Castings and forgings, rough kilograms	522	1,369	--	Australia 1,152; United Kingdom 182.
Lead metal including alloys, unwrought and semimanufactures[3]	2	1	--	All from United Kingdom.
Nickel metal including alloys, unwrought and semimanufactures _ kilograms	345	284	--	New Zealand 180; Australia 54; Canada 50.
Platinum-group metals including alloys, unwrought and wrought _ troy ounces	97	19	--	United Kingdom 16; New Zealand 3.

See footnotes at end of table.

Table 3.—Fiji Islands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
METALS —Continued				
Silver metal including alloys, unwrought and wrought value	$12,921	[4]$8,428	--	Australia $7,174; New Zealand $1,254.
Tin metal including alloys:				
Waste and scrap kilograms	1	1	--	All from Australia.
Unwrought and semimanufactures value, thousands	$1,700	$1,735	(1)	Japan $1,718; United Kingdom $15.
Titanium oxides	376	264	--	Australia 156; West Germany 108.
Zinc metal including alloys:				
Waste and scrap	5	1	--	All from Australia.
Blue powder value	$36,811	$55,224	--	Australia $39,406; New Zealand $15,800.
Unwrought	36	66	--	Mainly from Australia.
Semimanufactures value	$22,781	$21,599	--	New Zealand $9,652; Australia $9,364; Japan $1,453.
Other:				
Ores and concentrates kilograms	4	--		
Ash and residue containing nonferrous metals	140	52	17	United Kingdom 35.
Oxides, hydroxides, peroxides	58	54	(1)	Australia 15; West Germany 13; United Kingdom 12.
Base metals including alloys, all forms value	$20	--		
NONMETALS				
Abrasives, n.e.s.:				
Natural: Pumice, emery, corundum kilograms	10,202	53	--	India 52; New Zealand 1.
Grinding and polishing wheels and stones value	$75,664	$133,377	$1,816	Australia $51,084; New Zealand $41,947; United Kingdom $18,029.
Natural and artificial powders and grains do	$106,048	$125,283	$272	New Zealand $61,138; Australia $47,154; India $9,541.
Asbestos kilograms	--	273	5	United Kingdom 268.
Barite and witherite	10	31	1	Australia 15; New Zealand 13.
Cement	31	50	--	United Kingdom 43; Australia 7.
Chalk, earth colors	181	161	(1)	New Zealand 78; United Kingdom 73; Australia 8.
Clays and clay products including all refractory brick:				
Crude clay	427	149	90	Australia 44; New Zealand 11; United Kingdom 4.
Products:				
Refractory including nonclay brick value	$211,376	$509,577	--	Australia $327,451; New Zealand $159,113.
Nonrefractory do	$662,725	$736,617	$566	United Kingdom $247,396; Japan $125,964; Italy $120,134.
Diamond, industrial do	$42,698	$2,231	--	Australia $1,278; India $953.
Diatomite and other infusorial earth	49	91	75	Australia 15.
Fertilizer materials:				
Crude:				
Nitrogenous	--	6	--	Mainly from Denmark.
Potassic kilograms	1	6	(1)	United Kingdom 5.
Manufactured:				
Nitrogenous	50,587	45,114	--	Republic of Korea 34,061; Japan 10,581.
Phosphatic	13,447	10,286	--	New Zealand 8,321; Republic of Korea 1,100; Japan 801.
Potassic	3,031	2,241	--	New Zealand 1,429; Singapore 703; West Germany 100.
Other including mixed	488	428	1	Australia 224; West Germany 160; Japan 35.
Graphite:				
Natural kilograms	294	1,486	--	Australia 1,177; New Zealand 308; Sweden 1.
Artificial value	$1,277	$528	--	Australia $435; United Kingdom $93.
Gypsum and plasters	910	537	--	Australia 517; New Zealand 18.
Lime	85	229	--	United Kingdom 227; New Zealand 1.
Magnesite	2	--		
Mica:				
Crude including splittings and waste	2	3	--	Australia 2; Republic of South Africa 1.
Worked value	$1,371	$118	--	Australia $95; Japan $23.

See footnotes at end of table.

Table 3.—Fiji Islands: Imports of mineral commodities —Continued

(Metric tons unless otherwise specified)

Commodity	1978	1979	Sources, 1979	
			United States	Other (principal)
NONMETALS —Continued				
Precious and semiprecious stones, except diamond——value	$74,605	$89,547	$164	United Kingdom $37,118; New Zealand $21,157; India $13,114; Hong Kong $13,092.
Pyrite, unroasted ——kilograms	--	14	--	All from New Zealand.
Salt	2,983	3,043	(1)	West Germany 1,644; Australia 568; United Kingdom 464.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	845	1,042	18	United Kingdom 642; West Germany 271; Australia 80.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked kilograms	501	--		
Worked——value	$18,827	$31,968	$357	New Zealand $12,753; Australia $8,660; Japan $3,437.
Gravel and crushed rock	6	15	--	New Zealand 14.
Quartz and quartzite ——kilograms	--	875	--	New Zealand 625; Spain 250.
Sand excluding metal-bearing	148	139	1	New Zealand 123.
Sulfur:				
Elemental:				
Other than colloidal ——kilograms	4	2,040	2	Australia 2,038.
Colloidal——do	2,001	1	1	
Sulfuric acid, oleum——value	$64,406	$74,003	$354	Australia $39,145; New Zealand $32,556; Japan $1,450.
Talc, steatite, soapstone	4	9	--	New Zealand 4; Australia 3; India 2.
Other:				
Crude	5	(1)	--	All from Australia.
Slag, dross, similar waste, not metal-bearing:				
From manufacture of iron and steel kilograms	--	720	--	Do.
Other——do	681	98	--	All from India.
Acids and oxides——value	$89,459	$96,998	$727	Australia $47,066; New Zealand $21,685; Japan $17,410.
Activated natural minerals ——do	$25,769	$66,378	$9,455	Japan $45,848; Australia $4,651.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals do	$876,006	$885,732	--	New Zealand $852,760; United Kingdom $18,475.
Unspecified——do	$241,260	$203,303	$30,760	Australia $98,015; United Kingdom $19,675; New Zealand $19,177.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,489	1,881	--	Japan 1,604; New Zealand 150.
Carbon black and retort carbon ——kilograms	--	1	1	
Coal, all grades including briquets and coke	25,504	23,124	--	Australia 23,123; New Zealand 1.
Hydrogen, nitrogen, rare gases	13	31	--	United Kingdom 13; Australia 10; New Zealand 6.
Petroleum:				
Crude and partly refined 42-gallon barrels	4	3	--	Mainly from United Kingdom.
Refinery products:				
Gasoline including natural:				
Motor thousand 42-gallon barrels	494	527	--	Australia 415; Singapore 112.
Aviation——do	50	34	--	Australia 23; Singapore 11.
Kerosine——do	171	173	--	Australia 137; Singapore 36.
Jet fuel——do	512	786	--	Australia 714; Singapore 72.
Distillate fuel oil——do	1,230	1,296	--	Australia 1,034; Singapore 262.
Residual fuel oil——do	179	126	--	All from Australia.
Lubricants——do	29	39	(1)	Australia 33; New Zealand 5.
Other:				
Liquefied petroleum gas ——do	24	32	(1)	Australia 31.
Naphtha——do	29	25	--	Australia 18; Singapore 7.
Unspecified——do	9	3	(1)	Mainly from Australia.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals——value	$57,669	$76,392	$7,170	New Zealand $29,684; Australia $27,100; United Kingdom $9,969.

[1]Less than 1/2 unit.
[2]Totals exclude unreported quantities valued at $442,909 in 1978 and $958,486 in 1979.
[3]Totals exclude unreported quantities valued at $190,419 in 1978 and $181,970 in 1979.
[4]Excludes imports of silver bullion in 1979 of 42 troy ounces.

NAURU AND KIRIBATI

The Republic of Nauru and Kiribati (the latter includes Ocean Island) lie halfway between Honolulu, Hawaii, and Melbourne, Australia. Kiribati, the former British colony consisting of Ocean Island, Gilbert Islands, Line Islands, and Phoenix Islands, became independent on July 12, 1979.

Phosphate rock production by Nauru Phosphate Corp. totaled 2.0 million tons in 1980; no production was reported from Kiribati. Nauru exported 55% of its total output to Australia and 30% to New Zealand, with the remaining 15% to Japan and South Korea. The price of Nauru's phosphate generally follows Florida price trends, with allowance for quality.

Most of the phosphate was mined from between limestone pinnacles using grab buckets. Means were being investigated to recover the residual phosphate estimated to be 6% to 7% of the total.

Present reserves of phosphate rock in Nauru were estimated at 36 million tons.

Table 4.—Nauru and Kiribati:[1] Shipments of phosphate rock, by destination

(Thousand metric tons)

Destination	Nauru		Banaba Island	
	1978	1979	1978	1979
Australia	1,259	1,315	302	236
Indonesia	--	16	--	--
Japan	92	110	--	--
Korea, Republic of	39	66	--	--
New Zealand	609	321	166	210
Total	1,999	1,828	468	446

[1]Data presented for the Republic of Kiribati represent shipments from the island of Banaba, which, prior to the establishment of the Republic, was known as Ocean Island.

Source: International Superphosphate and Compound Manufacturers' Association, Ltd. Table on "Exports by Destination From the Countries Included in Various."

NEW CALEDONIA

The French island territory of New Caledonia was the second largest producer of nickel in the market economy countries in 1980. Output of nickel by Société Métallurgique le Nickel (SLN), New Caledonia's only producer, declined in 1980, resulting from lower demand throughout most of the year. In addition to nickel products (nickel matte and ferronickel), byproduct cobalt matte resulting from nickel smelting operations was also produced by SLN. Other minerals produced in New Caledonia included chromite, and pit and quarry construction materials. Nickel exports remained at about the 1979 level.

Nickel ore was produced at four major locations, three (Thio, Kouaoua, and Poro) near the east coast and one (Népoui) near the west coast. Work to expand output on Népoui to 2 million tons of ore per year and at Kouaoua to 1.5 million tons per year was nearing completion. Production of nickel ore totaled some 4.3 million tons in 1980.

In 1979, operations of SLN's refinery were severely affected by a fire, but the refinery operated normally throughout 1980. The output of metallurgical products (nickel matte and ferronickel) totaled 44,500 tons, compared with 43,000 in 1979.

Exports in 1979 were valued as follows (in thousands): Ore—$49,398;[3] matte—$54,644; and ferronickel—$125,755. The export value for nickel matte declined slightly, but the values for ore and ferronickel showed substantial improvements.

The cobalt content of the nickel ore mined in New Caledonia during 1980 was 2,239 tons, but the total recovered metal was estimated at 180 tons. The cobalt content in either the total ore production or in the intermediate metallurgical products was recoverable as cobalt or cobalt chemicals. A significant part of the total remained in nickel products.

Amax Nickel Inc. and Bureau de Recherches Géologiques et Minières (BRGM), the French Government-controlled agency, began work that would lead to a joint

development of an integrated nickel project in the Tiebaghi, Poum, and Isle d'Art regions at the northern end of New Caledonia. The agreement covers feasibility and financing studies and ultimate mine and plant construction and operation. The cost of the project was estimated at $600 million. Reserves of 55 million dry tons of ore at 2.5% nickel in garnierite, including 10 million tons of 3% nickel, would be mined at a rate of 1 million tons per year. Amax was interested in shipping nickel matte from this smelter to its Port Nickel refinery in Louisiana.

Inco Ltd. of Canada, under agreement with the New Caledonian Government, continued studying the possibility of development of lateritic nickel deposits in the southern part of the Island. Inco was required to take a French partner before the project reaches its development stage.

Production of chromite ore in 1980, containing 34.6% Cr_2O_3, in the Tiebaghi area, exceeded that for 1979. Chromite exports, principally to Japan, had a combined value of $505,247 in 1980. Société de la Tiebaghi, subsidiary of Inco Ltd., continued a drilling program that began in 1977.

Energy requirements were considered a potential problem since New Caledonia had no domestic energy resources. All fuel oil was imported to New Caledonia, and there were no known domestic energy resources except for the possibility of developing hydroelectric energy sources in the Plaine de Lacs area. SLN used 85% of the industrial electricity in its mining and smelting operations.

Table 5.—New Caledonia: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979
Chromite, gross weight (50.045% Cr_2O_3)	4,734	4,345	11,563
Manganese ore, gross weight	130	--	--
Nickel ore, gross weight[1] thousand tons	2,604	1,540	2,142
Smelter products, nickel content:[2]			
Ferronickel, all grades	29,465	25,241	44,475
Nickel matte (79% nickel-cobalt)	23,991	16,511	13,411

[1]Nickel-cobalt content is reported as follows in tons: 1977—46,787; 1978—28,025; 1979—not available.
[2]Cobalt content of smelter products is not available.

Table 6.—New Caledonia: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1977	1978	1979
METALS			
Iron and steel metal, all forms	8,065	9,301	8,546
NONMETALS			
Cement	50,741	31,816	41,497
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades	124,598	44,105	87,906
Coke and semicoke	34	36	85
Petroleum refinery products:			
Gasoline 42-gallon barrels	465,509	422,619	449,130
Kerosine do.	32,520	28,927	32,303
Distillate fuel oil do.	386,495	295,058	279,399
Residual fuel oil do.	3,154,669	2,148,862	2,349,881

PAPUA NEW GUINEA

Papua New Guinea (PNG) has abundant mineral resources, particularly copper, but only one operating mine. The only other minerals produced were small quantities of limestone and sand for local use, and some gold in the Bulolo-Wau area. However, in addition to the operating mine (Bougainville), which produced copper, gold, and silver, exploration work on two other major deposits has begun. These two deposits, OK

Tedi located in the Star Mountains in the center of PNG and Frieda River near Madang, also have large copper resources. The principal obstacles to commercial development have been the current depressed price of copper and the difficulty of access to these remote areas. Nevertheless, these mines are expected to be operational in the late 1980's. Bougainville Copper Ltd.'s mine at Panguna on North Solomon Island (Bougainville) contributed significantly to Government revenues and the gross domestic product (GDP), estimated at $1.96 billion[4] in 1980. Values of 1980 output were as follows: Copper—$175 million, gold—$128 million, and silver—$7 million. Total production value of $310 million was nearly 16% of the GDP. Despite the mineral industry's importance financially, it employed only about 7,200 people out of a total work force of over 350,000.

The Government of PNG sponsored its first investment seminar in the United States during 1980. The stated objective of the seminar was to offer U.S. corporations opportunities to invest in PNG's minerals resources. The newly enacted legislation relating to the exploitation of mineral resources was discussed. Development of mining and petroleum projects was considered to be of the highest priority, and the basic principles of the legislation adopted were as follows:

Mineral resources belong to the people of Papua New Guinea and the Government, and the people must receive a fair price in return for extraction of the minerals.

Foreign enterprises exploiting Papua New Guinea's mineral resources deserve a reasonable return on their investment, but extraordinary gains above a reasonable return on investment will go in large part to the Government.

The Government has the right to regulate extractive enterprises so as to maximize the benefits to the local community, while minimizing the potentially harmful social and economic costs.

A number of porphyry copper and hydrocarbon projects were under investigation in 1980. There are proven gasfields, although there are so far no reports of oil being found in commercial quantities. Exploration was also underway for chromite, nickel, bauxite, manganese, and mercury.

COMMODITY REVIEW

Metals.—*Chromite.*—A joint venture formed by Nord Resources Corp., Highlands Energy Corp., and Nord Australex Ltd. has found chromite mineralization at several locations in PNG and plans to develop one area. Reserves in excess of 5 million tons have been discovered at the Ramu River concession. The find was on part of a 246-square-kilometer concession in the Ramu River area, close to the deepwater port of Madang. Amax Exploration Australia Inc., a subsidiary of Amax, continued evaluating chromite and other minerals in beach sands along the Morobe coast, between Salamaua and Salua. Preliminary estimates indicated reserves of 200 million tons of mineralized sands containing 1.5% chromium.

Copper.—Bougainville Copper Pty. Ltd.'s (BCL) mine at Panguna remained the only significant mining operation in Papua New Guinea. The 1980 output of all three commodities—copper, gold, and silver—was below the 1979 level. This resulted from both a decline in tonnage and grade of ore milled. About 34 million tons of ore were treated in 1980, compared with 36 million tons in 1979. In 1980, the copper content declined to 0.47%, while gold and silver were 0.024 troy ounce per ton and 0.058 troy ounce per ton, respectively. The content of these constituents was expected to continue the downward trend, as mining operations extend into lower grade sections of the ore body. The company was building its 11th primary ball mill.

In 1980, sales totaled 142,240 tons of copper, 440,037 troy ounces of gold, and 900,000 troy ounces of silver. Concentrates were shipped under long-term contracts to Japan, the Federal Republic of Germany, and Spain.

The Papua New Guinea Government formally announced its conditional approval for the development of the copper-gold deposits at OK Tedi, in the remote Star Mountains in the center of Papua New Guinea. The feasibility study of the porphyry copper deposit, which included engineering design work, metallurgical testing, and economic evaluation, was continued. The study was being carried out by a consortium under the leadership of Broken Hill Pty. (BHP), which began work at OK Tedi in 1976. The consortium consisted of Dampier Mining Co. Ltd., a subsidiary of BHP Co. (30%); Mount Fubilan Development Co. Pty. Ltd., a subsidiary of Amoco Minerals Ltd. (30%); Kupferexploration GmbH, a West German group, (20%); and PNG Government (20%). Situated near the West Irian

border, the deposit has ore reserves estimated at 300 million tons. Ore grade averaged 0.85% copper and 1.8 troy ounce per ton of gold, with some molybdenum. Under the agreement with Papua New Guinea, the consortium presented the feasibility study to the Government on May 31, 1979. A hydrographic, geophysical, and geological investigation of the Fly River to assess the feasibility of transporting copper concentrates from OK Tedi via barge from Kiunga on the Fly River to an as-yet-to-be-selected deepwater port on the Gulf of Papua was continued.

Exploration also continued on the Frieda River porphyry ore body estimated to contain 500 million tons, averaging 0.5% copper. Although this is a major ore body located in the Western Sepik Province, development could be hampered by its low grade. The leases were held by MIM Holdings Ltd., and work carried out by Japanese interests earned them a 40% share in the holding.

On Manus Island, 360 kilometers north of the PNG mainland in the Admiralty Group, joint venture exploration by Exoil NL and Transoil NL indicated 160 million tons of ore at 0.32% copper, associated with gold, silver, and molybdenum, in ore of several known prospects. Some factors acting in favor of the Manus prospect were the limited infrastructural development required and relatively good accessibility compared with the mainland deposits.

Gold and Silver.—With high prices, gold continued to be an important byproduct of BCL's Panguna copper mine. The gold sales totaled some 600,000 troy ounces during 1980. Byproduct silver recovery was about 1.3 million troy ounces.

Output by New Guinea Goldfields Ltd. at Wau, where ore averaged 0.08 ounce per ton, remained relatively small.

At Porgera in Papua New Guinea's central mountain range, Placer Development Ltd., MIM, and Consolidated Goldfields of Australia were engaged in a joint venture to explore and develop an alluvial gold deposit. Two zones have been explored; one was estimated to be 250 meters long, 150 meters wide, and up to 250 meters deep, and to average 0.07 ounce per ton of gold and 0.13 ounce per ton of silver. The other had a length of 420 meters, a width of 250 meters, and a depth of 240 meters, and averaged 0.08 ounce per ton of gold and 0.13 ounce per ton of silver. The results suggest the possibility of a large gold mine, but work was still at an early stage of development.

Mineral Fuels.—*Petroleum.*—Petroleum prospecting continued, but no significant discoveries were reported. The Papua New Guinea Government signed petroleum prospecting concession agreements with Gulf Oil Corp., Australasian Oil Ltd., and BP Petroleum Development Australia Pty. Ltd. The concession areas involve two permits (76 and 77). Permit 76 covered 7,300 square kilometers in the Western Province, and permit 77 covered 13,400 square kilometers in the Western and Southern Highlands Provinces. The cost of exploration over a 3-year period was estimated at $7 million. In another development, Esso Papua New Guinea Inc. announced it had spudded the Goari No. 1 well on the Paibuna River, 415 kilometers northwest of Port Moresby. Planned depth is 11,500 feet, and it is estimated that the well would take 55 days to complete.

Recently passed legislation by the PNG Government would entitle it to receive 60% to 80% of any future revenues from oil or gas production. This would be in the form of a 1.25% royalty based on wellhead values, a petroleum income tax of 50% of taxable income, a profits tax after an agreed rate of return is achieved, and a Government equity up to 22.5% with payment from the Government's share of production.

Table 7.—Papua New Guinea: Exports of copper, by destination

(Metric tons of copper content)

Destination	1977	1978	1979
China, mainland	2,983	6,049	6,398
Germany, Federal Republic of	58,670	62,737	54,985
Japan	99,564	98,303	96,282
Korea, Republic of	--	1,448	--
Spain	14,054	18,589	14,332
Other	6,758	7,924	--
Total	182,029	195,050	171,997

SOLOMON ISLANDS

In 1980, Solomon Islands' minerals output consisted of small quantities of alluvial gold and silver, valued at an estimated $260,000.[5] In addition, marine shells were harvested for lime, but production was not reported.

The Government continued to actively seek foreign investors as a major force in the country's resource development. A bauxite mine and refinery project on Rennell and Vaghena Islands have been surveyed but temporarily shelved due to low world bauxite prices. Conzinc Riotinto Australia Ltd. (CRA), in partnership with Mitsui Mining and Smelting Co. Ltd. and the Solomon Islands Government, withdrew from the project, and Mitsui decided to defer further work because of the lack of market for aluminum. The project was to produce 1.5 million tons of bauxite and 600,000 tons of alumina per year from reserves estimated at 60 million tons of 45% to 50% Al_2O_3.

In addition to bauxite, other minerals known to exist in Solomon Islands were phosphate on Bellona and Rennell, copper on Guadalcanal and Florida, nickel on Isabel, manganese on Florida, and gold on Guadalcanal. Currently, these mineral deposits were regarded as uneconomic prospects because of the small size of known occurrences.

The Government was particularly interested in receiving proposals for prospecting for hydrocarbons both onshore and offshore. A Petroleum Act establishing the framework to enable orderly prospecting and development to be carried out by commercial companies was completed. Within the terms of the act, detailed agreements between individual companies and the Solomon Islands Government concerning work programs, expenditure levels, and the extent and nature of Government participation were considered.

TONGA ISLANDS

In 1980, there were no active mineral exploration ventures in Tonga. In the future, there may be some mineral potential in the country resulting from mining manganese nodules and precious coral. Also, the Tonga Government and Webb Resources of Colorado, an independent U.S. oil company, were conducting negotiations for Webb to drill two offshore wells.

VANUATU (NEW HEBRIDES)

Vanuatu (formerly New Hebrides) was granted independence in July 1980. A condominium government between Britain and France had ruled the 70-island territory since 1906.

Vanuatu's only mine, located at Forari, 55 kilometers northwest of Port Vita on Vate (Efaté) Island, remained closed in 1980. The mine, which produced manganese concentrate, was operated by Le Manganese de Vate (LMV) and owned by Southland Mining Ltd. of Australia (87.5%) and public shareholders (12.5%). The closure was attributed to the decline in world steel demand. The mine is expected to reopen at some future date, although only some 120,000 tons of commercially minable reserves remain in the Forari Mine. The

company had 100 employees, largely native Vanuatuans, and shipped a 40% to 42% manganese concentrate of metallurgical grade. The market value was $35 per ton for 40% manganese products.

Manganese concentrate was the only mineral exported in recent years, but various mineral deposits were under investigation. Samples of pozzolan, a consolidated volcanic ash, on Efaté and other islands, were being evaluated in Australia and Fiji for use in cement. Surveys have taken place in recent years in search of nickel, copper, bauxite, sulfur, and zinc. None of these commodities were expected to be mined in the foreseeable future.

[1]Supervisory physical scientist, Branch of Foreign Data.

[2]Where necessary, values have been converted from Fijian dollars (FD) to U.S. dollars at the rate of FD1 = US$1.16.

[3]Where necessary, values have been converted from Communaute Financiere Pacifique francs (CFPF) to U.S. dollars at a rate of CFPF81.80 = US$1.00.

[4]Where necessary, values have been converted from Papua New Guinea dollars (K$) to U.S. dollars at the rate of K$1 = US$1.49.

[5]Where necessary, values have been converted from Solomon dollars ($S) to U.S. dollars at the rate of $S1 = US$1.15.

Table 8.—Vanuatu: Exports of manganese ore

Year	Manganese ore, 40% to 42% Mn (metric tons)
1977	23,040
1978	20,732
1979	10,544

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